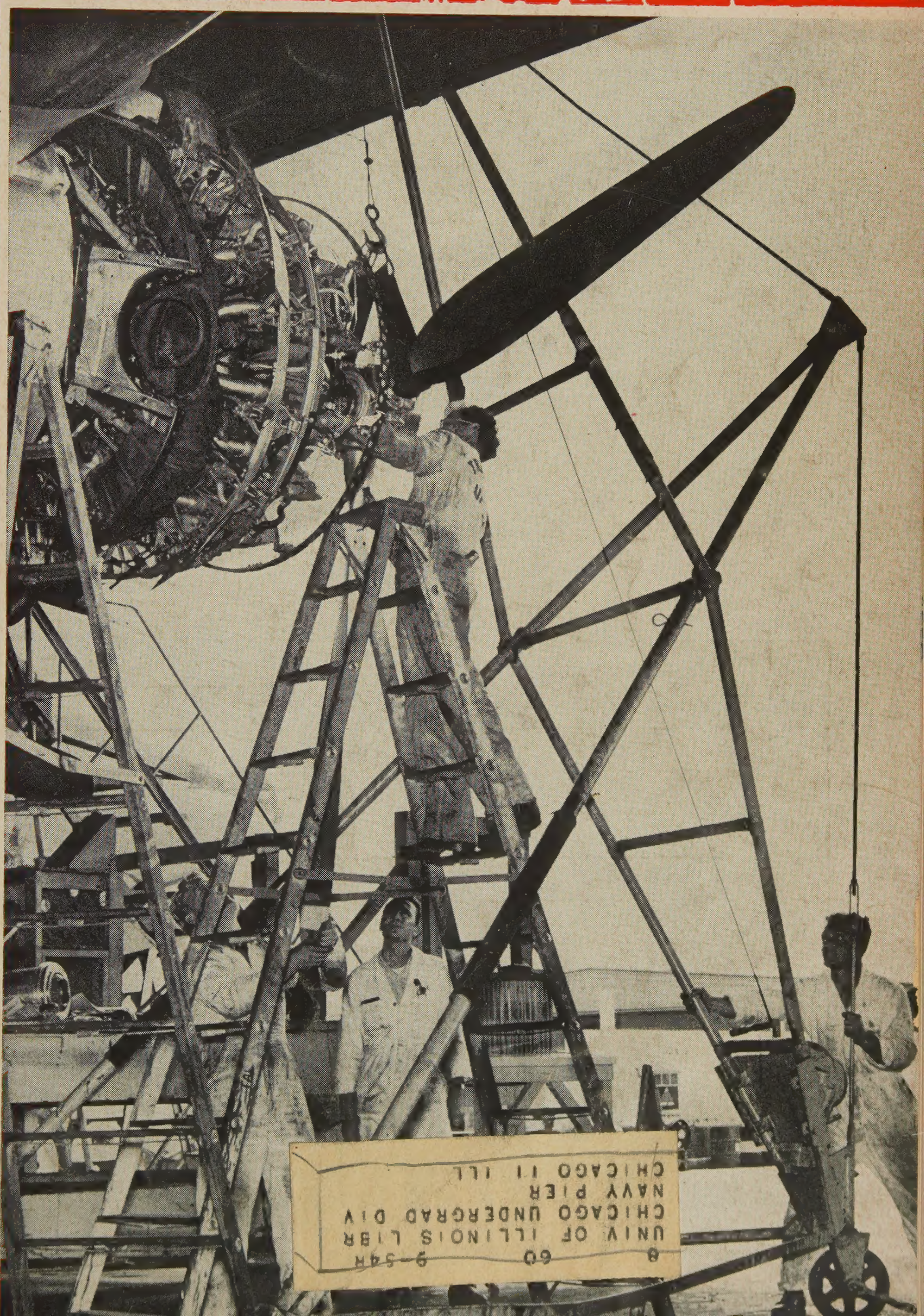
Skyways

Flight Operations
•
Engineering
•
Management



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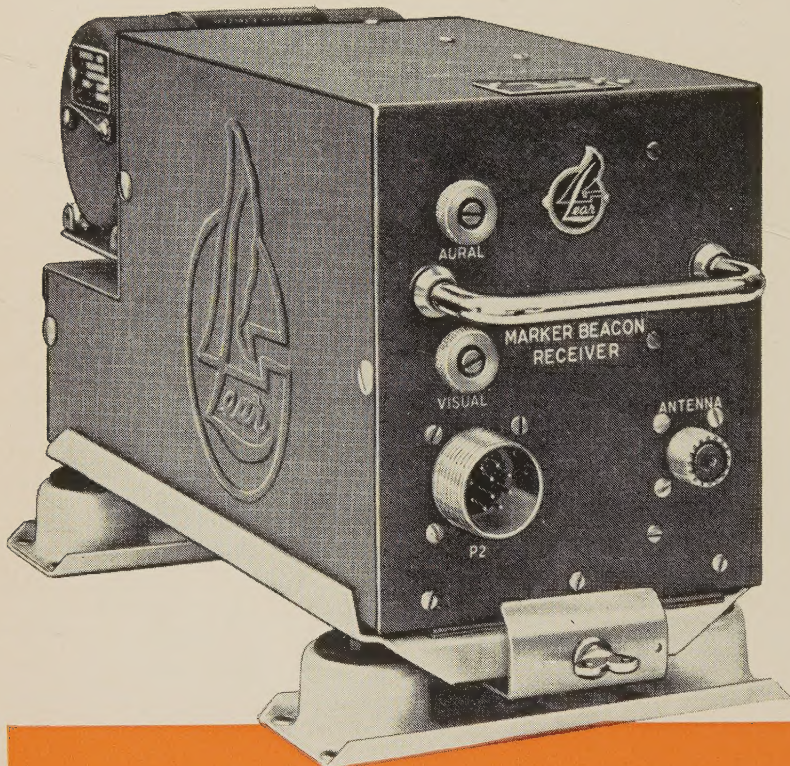

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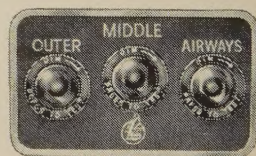

	LEAR	MAKE "A"	MAKE "B"	MAKE "C"	MAKE "D"
CAA Type Certificated.	✓	✓	✓	✓	✓
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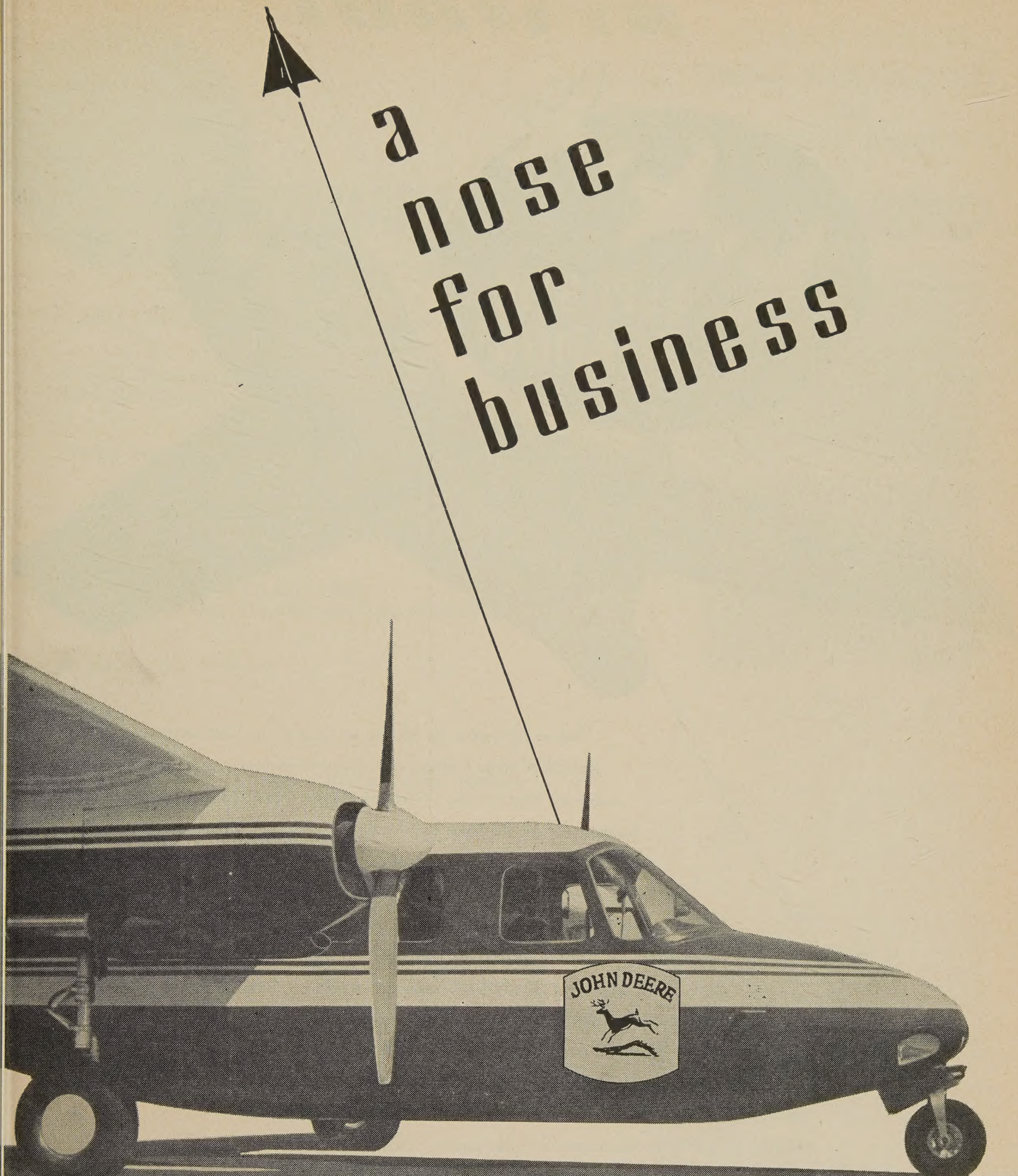
Total weight less than eleven pounds.	✓			✓	✓
Less than ¼ cu. ft. of space required for mounting.	✓				✓
Self-contained power supply — independent of other power sources.	✓	✓	✓	✓	
ARINC tubes — the industry's highest standard — fully utilized.	✓	✓			
Provision for speaker operation as well as headset.	✓				
Three individual indicator lights for outer and middle markers, and airways beacons.	✓	✓	✓	✓	
Press-to-test indicator lamps.	✓	✓		✓	✓
Hi-Lo sensitivity switch, permitting pickup of weak signals or suppression of overly strong or spurious signals.	✓	✓	✓	✓	
Aural and visual sensitivity individually adjustable to pilot preferences and to various installations.	✓	✓	✓		
Cost under $600.00.	✓			✓	✓
***Only the Lear Marker Beacon Receiver combines all these features**	**12**	**8**	**6**	**7**	**5**



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MARCH, 1954

Skyways

Flight Operations • Engineering • Management

Cover: Transocean Air Lines Overhaul DC-4

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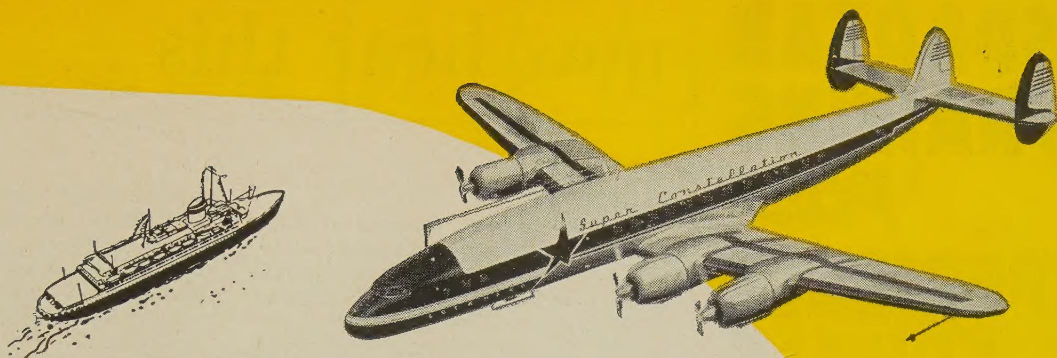
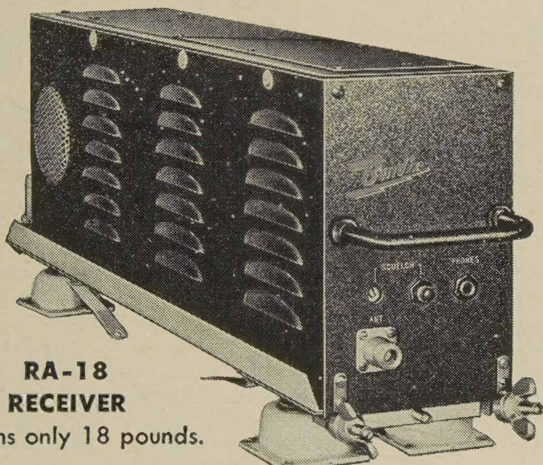
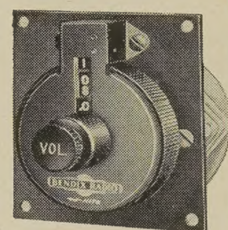


VHF COMMUNICATIONS



RA-18
RECEIVER
Weighs only 18 pounds.



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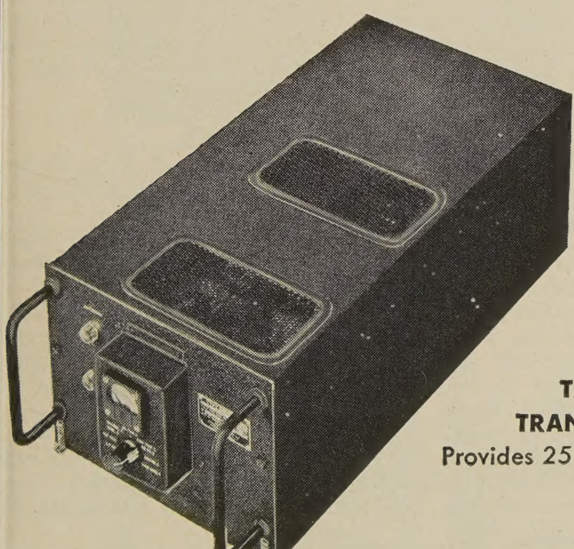

TA-18
TRANSMITTER
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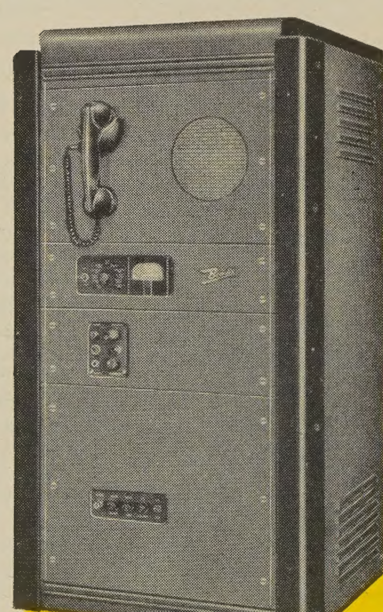

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GROUND STATION
TRANSMITTER AND RECEIVER
Local or Remote Control

now hear this . . .

PERSONNEL

John L. Atwood, president of North American Aviation, has been elected president of the Institute of the Aeronautical Sciences for 1954. Mr. Atwood is a Fellow of the Institute. Other elected officials of IAS for this year include four vice presidents, **William A. M. Burden; E. S. Thompson** of Aircraft Gas Turbine Div., GE; **Edmund T. Price,** Solar Aircraft; and **John W. Larson** of Consolidated Vultee. **E. A. Sperry, Jr.,** of Sperry Products, Inc. was elected treasurer. **S. Paul Johnston** was re-elected Director of the Institute; **Robert R. Dexter** was re-elected IAS Secretary, and **Joseph Maitan,** Controller.

W. T. Piper, president of Piper Aircraft Corp., was named Chairman of the Utility Airplane Council of the AIA.

Charles B. Sweatt fills the newly created post of vice chairman of the board of Minneapolis-Honeywell Regulator Co. **Tom McDonald** and **A. M. Wilson** have been named executive vice presidents to assist Paul B. Wishart, M-H president.

Frank W. Hulse recently was elected to board of directors of the Conference of Local Service Airlines. Mr. Hulse is president of Southern Airways, Inc.

Dr. C. J. Breitwieser has joined Lear, Inc., as Director of Engineering. Dr. Breitwieser will head Lear's General Development and Engineering Division.

Walter G. Bain was elected a vice president of Republic Aviation Corp. by Republic's board of directors. Also at Republic, **William Ehrbar** succeeds Mr. A. C. Winters as purchasing manager, and **Wesley Pye** and **Vincent Suhr** have been named purchasing agents; Pye in charge of the Farmingdale purchasing section, and Suhr in charge of subcontracting.

Charles Fredericks recently joined Air Associates as a Sales Engineer. A well-known pilot and instrument-flying specialist, Chick Fredericks has accumulated over 20,000 hours of flying time.

W. E. P. Johnson has been named manager of Solar Aircraft's newly created European Division. In this country, **Kent M. Campbell** has been appointed manager of Solar's new Dallas-Forth Worth office; **William F. Cords** replaces Mr. Campbell as assistant manager of contracts, San Diego; and **Fred S. Hage, Jr.** has been named manager of Solar's Des Moines contracts office.

W. Waits Smith is now manager of the Aviation Gas Turbine Division of Westinghouse Electric Corp. A widely known authority on aircraft powerplant development and production, Mr. Smith is in charge of all phases of jet aircraft engine development at both Kansas City and S. Philadelphia plants.

COMPANIES

North American Aviation has been awarded a Navy contract for production of an undisclosed number of FJ-4's.

TEMCO Aircraft has purchased exclusive engineering and conversion rights for modifying Ryan Navions to Riley Twin configurations, from Dauby Equipment, original owner of Riley Twin conversion engineering.

Ryan Aeronautical Co. has been awarded a new production order for components on the General Electric J-47 jet engine and for afterburners on the newest model Wright jet engine.

Northrop Aircraft holds a new USAF contract for extensive boundary layer control research.

AWARDS

Leonard S. Hobbs received the 1953 Collier Trophy for his leading role in development of the Pratt & Whitney J-57.

Henry T. Harrison, manager of weather service for United Air Lines, was the 1953 recipient of the Robert M. Losey Award, bestowed by Institute of Aeronautical Sciences.

Dr. Donald Coles of California Institute of Technology, was the recipient of the IAS' Lawrence Sperry Award for 1953. Dr. Coles was cited "for fundamental contributions to the understanding of supersonic skin friction."

Ernest G. Stout, Staff Engineer in charge of hydrodynamic research and development at Consolidated Vultee, was selected to receive the Sylvanus Albert Reed Award by the American Honorary Fellows and Fellows of the IAS.

Capt. Charles F. Gell (MC) USN, of the Aviation Medicine Acceleration Laboratory, Naval Air Development Center, and the Univ. of Penn. School of Medicine, was chosen to receive the IAS' John Jeffries Award for 1953.

AERO CALENDER

Mar. 22-25—Institute of Radio Engineers National Convention, Hotel Waldorf Astoria, New York.

Apr. 5-6—Society of Plastics Industry (Canada), 12th Annual conference, Mount Royal Hotel, Montreal.

Apr. 19-20—Jointly sponsored Stanford Research Institute and USAF symposium on automatic production of electronic equipment. Fairmont Hotel, San Francisco.

Apr. 29-30—American Society of Tool Engineers, Convention Center, Philadelphia.

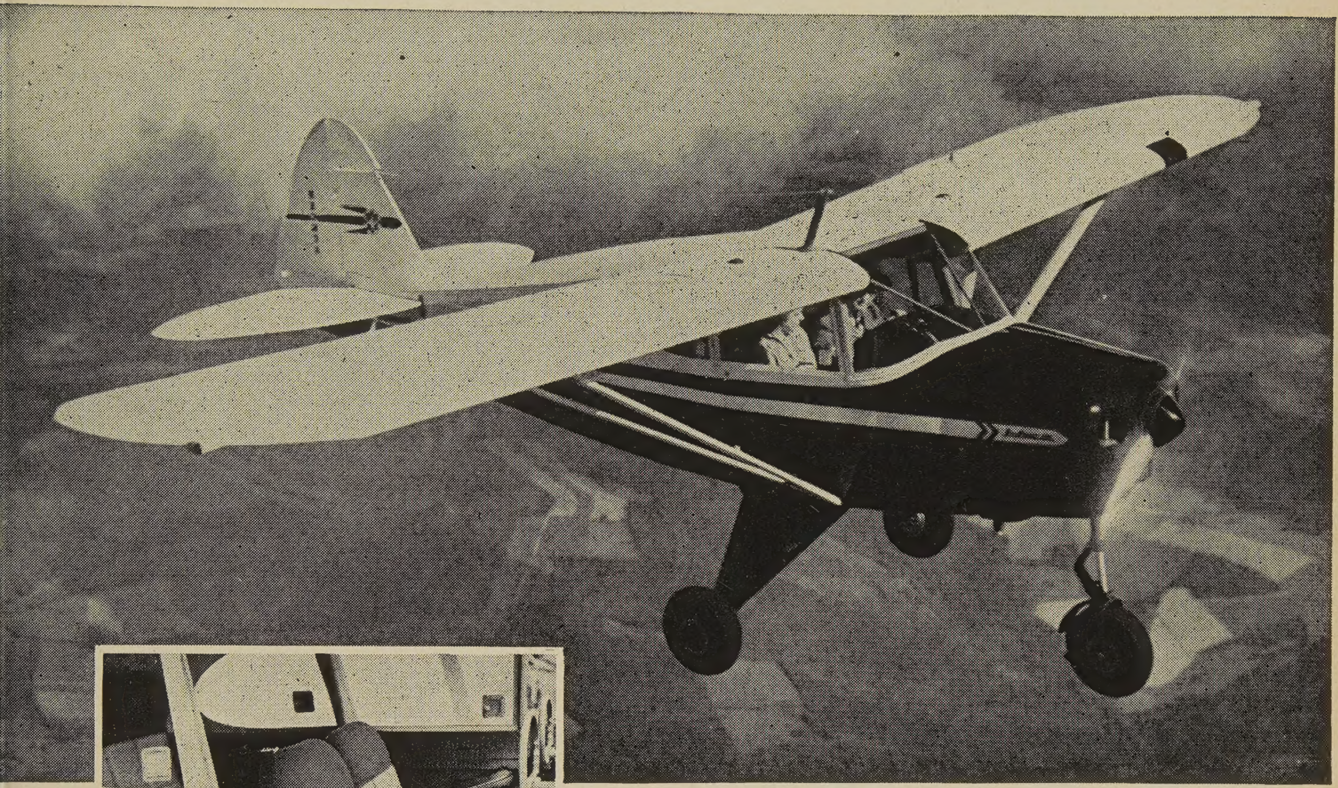
May 4-6—Electronic Components Symposium, Dept. of Interior Auditorium, Washington D. C.

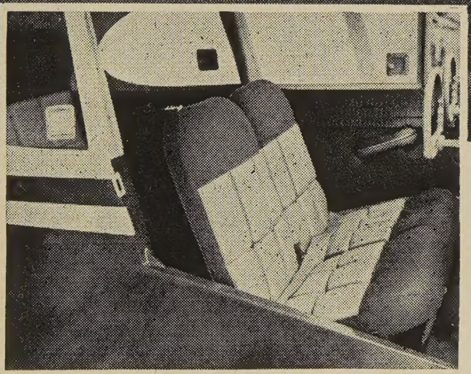
May 5-7—Third International Aviation Trade Show. 71st Regiment Armory, New York.

May 10-12—Convention on Airborne Electronics, Institute of Biltmore Hotel, Dayton, Ohio.

June 21-24—IAS Annual Summer Meeting, IAS Bldg, 7660 Beverly Blvd., Los Angeles, Cal.

PICK the PIPER Tri-Pacer for FLYING EASE





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TAKE A DEMONSTRATION FLIGHT in the handsome new 1954 Tri-Pacer and see for yourself the amazing flying ease, comfort and performance. Check these important features, too—tough, resilient, easy-to-repair Duraclad finish, beautiful two-tone styling, dependable Lycoming power, flaps for short field use, separate front and rear doors, "flight-planned" panel with room for full radio and instrumentation. Send today for full-color brochure.

The Piper Tri-Pacer is the easiest airplane to fly that's available today. With its tricycle landing gear, take-offs and landings are virtually automatic. Its rudder and ailerons are inter-connected to eliminate the need for coordination. It is so easy to fly a number of people have soloed after only one day of instruction—several after less than three hours!

Its flying ease is translated into comfort and safety, too. In rough air it is noted for its solid, big-airplane feel. Its stability and stall-resistance are so perfected that one leading editor and authority on personal airplanes wrote: the Tri-Pacer is "as stall- and spin-resistant as they come."

Yet for all its superb flying ease, stability and safety, the Tri-Pacer is an efficient, cross-country airplane, with over 120 mph cruising speed and over 575 mile range. And you get all this for nearly $2,000 less than any other four-passenger plane—for less than half the price of any other with tricycle landing gear. Little wonder the Tri-Pacer leads all others in sales.

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Lock Haven, Pennsylvania

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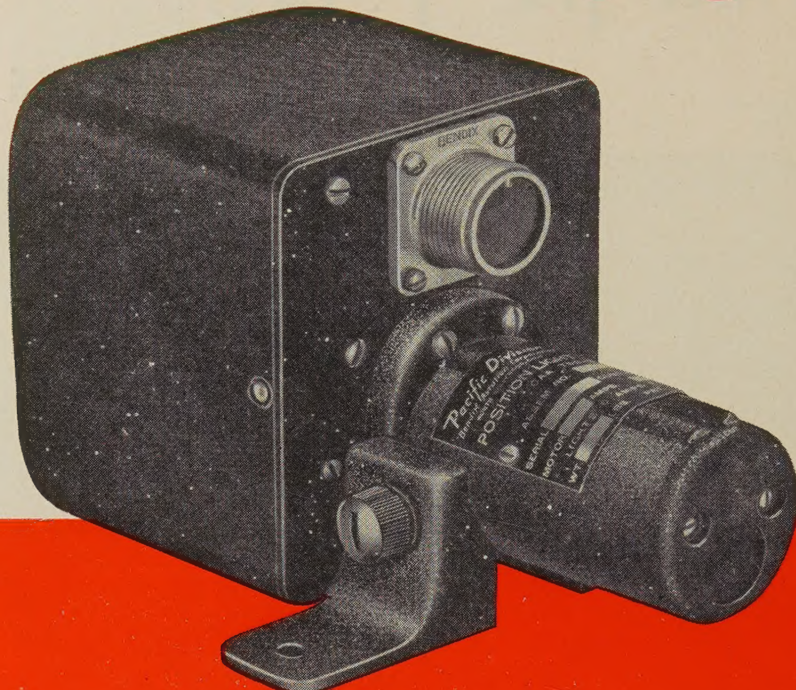
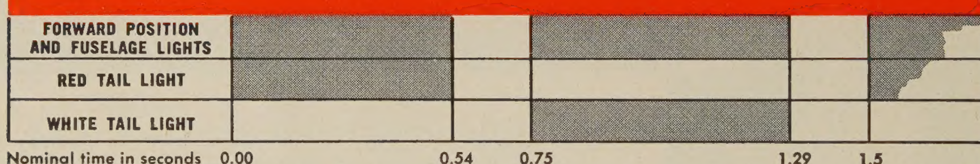


BENDIX-PACIFIC POSITION LIGHT FLASHER

MEETS C.A.A. REGULATION TSO-C18B, DATED OCTOBER 1, 1953



These dependable, light weight Position Light Flashers, which are in service on major airlines around the world, are now available with the new flashing cycle as illustrated above.

As in previous models, the new Bendix-Pacific Assembly 554230 incorporates a constant-speed, compound-wound ball bearing motor that assures accuracy of the flashing mechanism. Internal relay action also assures synchronization of fuselage and wing tip lights with either the red or white tail light. Relay contact points are designed to handle the increased current resulting from combining the forward position lights and fuselage lights in a common circuit.

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ATTENTION: Owners of Bendix Flashers:

Bendix-Pacific 450250-0-3 Flashers can readily be converted to conform to the new flashing schedule through the use of Bendix-Pacific kit #552490. For more information on this kit or other service parts contact Service Dept. at 117 E. Providencia, Burbank, Calif. or one of the offices or distributors listed below.

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pilot's viewpoint of Turbojet Control

Indications are that many military aircraft accidents are traceable to engineers' lack of sufficient consideration of pilot capabilities in their design of controls

As a former jet jockey and an active engineer in the turbojet controls field, it has often appeared to me that many engineers show a serious lack of realization of the turbojet problem as it appears to the average pilot. Military aircraft are designed to accomplish a given mission, usually destructive, after reaching a target, whether it be enemy aircraft or ground installation. To accomplish this a pilot must devote the major part of his energies and attentions to environmental conditions outside his aircraft. These include his own flight formation, other friendly and enemy aircraft, anti-aircraft oppositions, navigational aids, weather, and miscellaneous distractions. The lack of realization of these conditions by the design-engineer often results in insufficient consideration to designing controls within pilot capabilities. The importance of this cannot be overemphasized inasmuch as many of the military aircraft accidents which have occurred in the past few years can be traced to this factor. Lack of technological advancement in one way or another is often blamed, but behind it is the fact that the engineer often does not place himself in the position of a pilot with his life as well as an entire airplane in his hands.

Flight Operations

As a general rule pilots are not interested in the technical details of control systems. Whether these control systems are hydraulic or electronic, whether they are assembled by trial and error or analyzed by LaPlace transform, or whether or not they meet arbitrary technical requirements, are all incidentals. The pilot is interested in a system that, from the cockpit viewpoint, will be simple to operate, reliable, capable of safe-guarding the engine during his periods of distraction, and capable of giving the maximum performance consistent with these factors.

Let us examine the actual situation facing a pilot at one of the critical periods in any flight, *i.e.*, take-off: (To aid in visualizing flight conditions, refer to *Fig. 1*). The average jet fighter breaks ground on take-off at an approximate speed of 150 mph, or roughly 220 feet in each second of flight. This rapidly accelerates to around 275 mph, or two city blocks every three seconds. Although prior to the start of the take-off run the pilot has thoroughly checked his flight instruments, engine instruments, controls, flaps, dive brakes, fuel supply, emergency alert switches, radio equipment, lights, cabin pressurization, oxygen, and other assorted equipment, a few odd fuctions still remain. Once airborne, he must retract his landing gear, pull up the flaps, retrim his controls, check his engine instruments (from three to 10 of them), and check his flight instruments, while juggling his power to fly within a few feet of his element leader and only a few hundred feet from the ground. All this must be done while traveling at 150 to 275 mph.

At cruising altitude the pilot can ease up; but not much! Engine and flight instruments must still be rechecked, as must the other cockpit accessories. In addition, gun, rocket, bomb, and tank switches must be altered while the pilot is flying in formation, accomplishing his navigation to take him to his target, and watching for other friendly and enemy aircraft.

The landing operation is the reverse of taking off, but with additional complications in that the pilot cannot stop to figure out his next operation. While approaching and circling the field at 250 mph or more, he must keep his eyes open for other aircraft in the flight pattern, check his flight and engine instruments, trim his controls, drop his

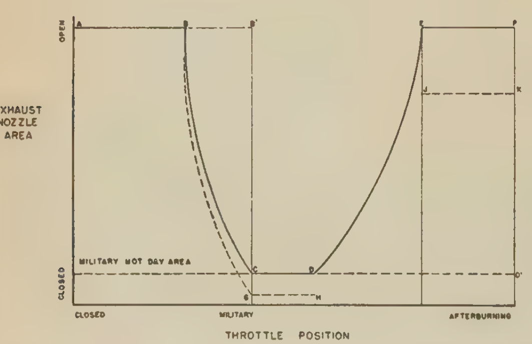


FIGURE 2 TURBOJET ENGINE EXHAUST NOZZLE AREA SCHEDULE

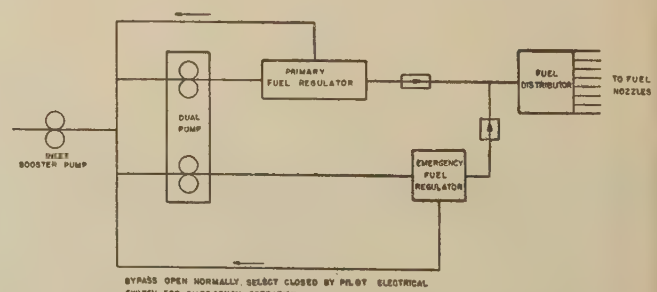


FIGURE 3 FUEL SYSTEM SCHEMATIC NON AFTERBURNING, FIXED AREA TURBOJET ENGINE

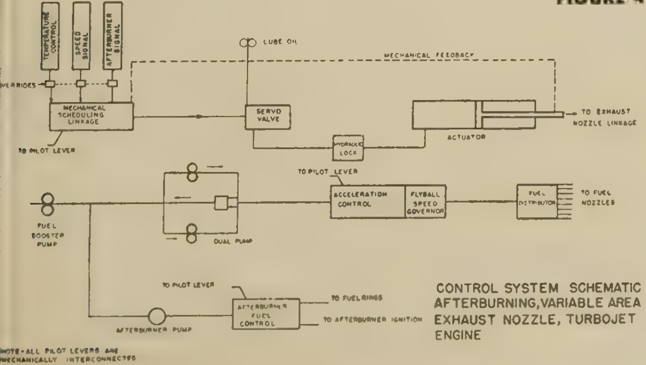
Requirements

by Robert E. LaCroix
Supervising Engineer, Aviation Gas Turbine Div.
Westinghouse Electric Corp.

dive brakes, select his fuel supply, alert his emergency system switch, call the control tower for landing instructions, and generally line up for his approach and landing pattern. Once his speed is reduced, he must drop and check his landing gear, recheck the radio control tower, and line up for a landing approach. On the actual approach he must carefully maintain speed within a few mph over stall, control his approach path, and drop flaps. If all goes right, he will finally land in the first third of the runway. However, a truck might suddenly drive on the runway, or his landing might be too far down the runway and a split-second decision is made to go around. The pilot jams the throttle forward to pick up power and speed. As soon as his aircraft stops mushing, he retracts the landing gear, simultaneously checking the air ahead, his flight speed, and his engine instruments. As soon as possible he must slowly raise his flaps to cut down drag, but not before his speed is high enough and he has sufficient altitude so he won't mush into the ground.

The point to be made from these details is that the pilot of military jet-type aircraft is far too busy to be able to concentrate more than a small percentage of the time on engine details. Insofar as possible controlling mechanisms must be simple and straightforward. In no case should a pilot be required to analyze or think through an emergency. Not that the average pilot cannot think, but when only a few hundred feet from the ground or from other planes, disaster is a matter of seconds or less. Time, then, absolutely precludes complications which tend to confuse or delay recognition of an emergency, or which could delay pilot reaction after recognition of an emergency and, conceivably, set the stage for disaster.

FIGURE 4



CONTROL SYSTEM SCHEMATIC AFTERBURNING, VARIABLE AREA EXHAUST NOZZLE, TURBOJET ENGINE

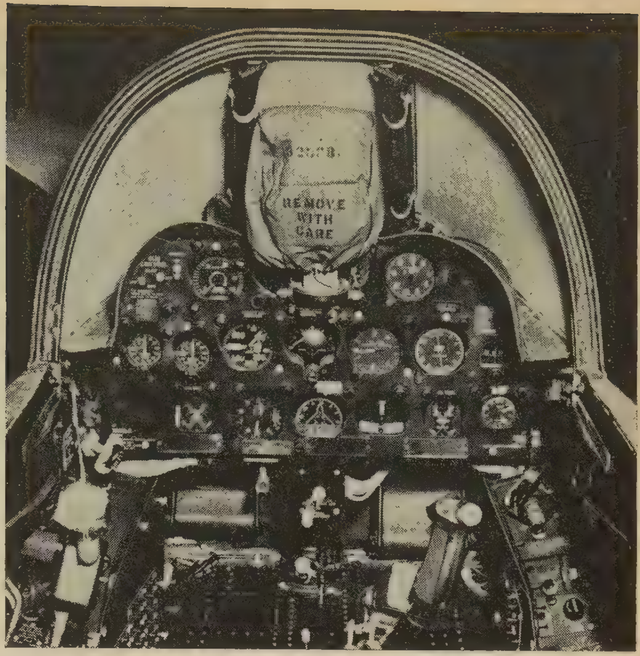


FIG. 1—*This partial view of a McDonnell Banshee fighter-plane cockpit shows the situation facing a pilot during take-off*

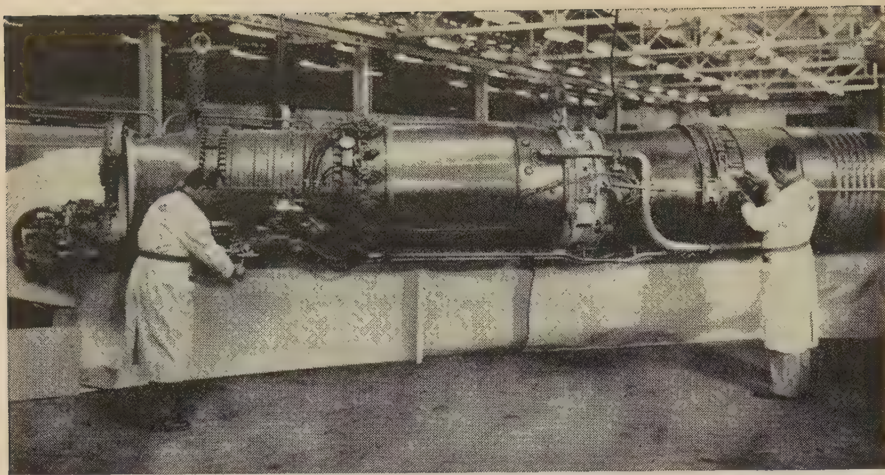
Control-System Design

On the basis of this flight-operation pattern, let us study the various engine controls and control systems.

Control requirements for the early, non-afterburning, fixed-nozzle engine configurations were simple, and controls consisting of simple bellows, hydraulic metering valves, and orifices were adequate.

As additional engine requirements complicated the controls picture, electronic devices were also used because they more readily lent themselves to the task of integrating various operational signals, including temperature thermocouple outputs. Numerous failures of these early control systems soon created a demand for emergency systems to back-up the basic controls, until today the original concept of a basically reliable control system has been practically forgotten. Recognizing this, and in order to fully evaluate the over-all control system, we should first determine what we mean by a "basically reliable system." Secondly, we should briefly review the emergency provisions by which flight reliability was supposedly improved and last of all, we should present certain design recommendations which will satisfy the pilot's operational requirements and also provide the requisite reliability.

Requirements for Reliability: The pilot is a normal individual who is just as interested in getting his aircraft safely home as he is in getting it airborne. Thus, the control system must be such that once the take-off run has progressed to a position on the runway which we might call the "point of no return," sufficient power must continue to be available to complete the take-off, circle the field, and land. This "point of no return" varies with each type of aircraft, but essentially we are referring to that position on the runway before which the pilot must initiate action to abort the take-off, otherwise the speed and physical limitations of the aircraft will take it beyond the end of the runway before it can be stopped. The actual amount of thrust-loss allowable varies



WESTINGHOUSE J-40 *axial-flow turbojet engine with afterburner powers the Douglas F4D and McDonnell Demon. Addition of afterburner to engines complicated control problem*

with the aircraft and the number of engines. Generally, a larger percent of thrust loss can be permitted for a given engine when more than one engine is powering the aircraft.

The conclusion to be drawn is that the effects of failures, whether due to mechanical failure or physical parts or to malfunctioning brought about by contamination of the system or other less common reasons, must not cause a sudden radical change in engine thrust. If an increase in thrust results from over-temperature or over-speed of the engine, it must not cause failure of the engine within a reasonable time period. If a decrease in thrust results, it must be limited by the requirements of the "point of no return."

Any system which can meet the requirements outlined above could be considered a reliable control system.

Emergency Provisions: The problem to be faced after recognition of the requirements of a reliable system is that of determining a method of achieving this reliability.

The thrust output of early, fixed-nozzle engines, was easily controlled. By metering fuel flow to the engine in response to rpm and ambient temperature and pressure signals, we directly controlled the engine rotative speed. This determined engine temperature and airflow and, therefore, thrust. The exhaust nozzle area was fixed at such a value that maximum turbine temperatures would be reached only under static sea-level hot-day conditions. This would correspond to line CD in *Fig. 2*. When engine failures on these early engines were believed due to control system malfunctioning, a clamor arose for an immediate "fix". The obvious "over-night" answer was to duplicate at least the fundamentals of the original system, thus the independent emergency system was developed.

Essentially most of these emergency systems were based on an independent, barometrically compensated control which could be selected manually by the pilot for in-flight emergencies. (*Reference, Fig. 3*) For take-off protection, an alert switch was engaged by the pilot which in one manner or another alerted the emergency system to take over in case the primary fuel system lost fuel pressure. In some cases the switch-over was based on pressure sensed by pressure switches. In other cases the emergency system, when alerted, simply scheduled and maintained a fuel pressure slightly below the primary schedule. When the primary pressure dropped below the emergency schedule, the emergency control delivered fuel to the engine. In either case, the big disadvantage was that if the pilot advanced his throttle too rapidly (as on an inadvertent go-around) with the emergency switch alerted, the emergency system would take over due to the fact that these simple emergency systems did not incorporate acceleration controls. The emergency fuel pressure would rise above the acceleration-limited primary pressure and, accordingly, take over control and damage the engine.

Other systems which were operationally quite similar utilized such fixes as locking the fuel valving in position for take-off or providing a simple throttle valve arrangement to schedule a fixed fuel flow for each position of the pilot's throttle lever.

From the pilot's viewpoint these systems all present the same basic problems:

(a) An independent alert switch must be actuated by the pilot to place these systems on stand-by. The switch is primarily for take-off protection and must be disengaged before climbing to altitude or before making jam accelerations. Further, a second switch must be provided so the pilot can, before take-off, manually check the emergency system and its transfer mechanism; and

(b) One or more warning devices must be provided to let the pilot know when he is operating on the emergency system and, in the more complicated systems, when and which portion of the system is operating on its back-up component.

In the case of afterburning engines with variable area exhaust nozzles, additional complications are introduced. The afterburner, which burns additional fuel after the turbine, increases the mass gas flow. In order to avoid excessive build-up of pressure and turbine temperatures, early afterburning engines increased the area of the exhaust nozzle from area CD to area EF in *Fig. 2*. In like manner, when the afterburner was turned off, the nozzle was closed to line CD in *Fig. 2* in order to maintain rated turbine temperatures and pressures.

The afterburning engine with the infinitely variable exhaust nozzle presents the most complicated control requirements. The two-position exhaust nozzle does not fully compensate for ambient conditions, ram, or partial afterburning augmentation, since each of the two areas must be at least as large as the area required for safe operation under 100°F day, static, sea-level operating conditions. (*Lines CD and EF in Fig. 2*) By providing an infinitely variable exhaust nozzle area, the control system is able to fully compensate for all flight and ambient conditions to maintain any desired turbine temperature and pressure ratio by closing the exhaust nozzle beyond the "hot day" setting, or to some position indicated in *Fig. 2* by line CH or JK. Little additional complication is introduced by opening the exhaust nozzle for acceleration of the engine rpm, which enables the

(Continued on page 41)

by E. T. Martin,
Supt. Training, Flight Safety, Inc.

FLIGHT on the Back Side of the POWER-REQUIRED CURVE

During the past few years some of the aircraft accident reports which have been published by the CAB have revealed circumstances which indicated that as a result of the emergency encountered, the aircraft was inadvertently handled in such a manner as to attempt flight on the back side of the power-required curve. Although this phraseology is fundamental in the aerodynamics of flight, its application under actual flight conditions is not often well known or recognized, and is frequently obscured by other factors which appear to predominate under a given flight condition.

Generally, an accident report will read as follows: "Twin-engine transport lost engine after take-off. Pilot unable to climb on good engine, and crash landed two miles from field. Investigation indicates aircraft and crew properly certificated, gross weight and C.G. within limits. Pilot unable to explain loss of airspeed and altitude resulting in decision to land. Good engine apparently delivering full power." This is about as far as the explanation goes. The report might suggest that the pilot may have used poor technique in delaying full-power application on the good engine, or allowing the airspeed to get too low, etc.

There are probably few pilots flying today who have not at some time during their flying career experienced the phenomenon known as flying on the back side of the power-required curve. The purpose of this article is to explain it and to show how it may have applied to some aircraft accidents. Perhaps the condition occurred in a small low-powered plane attempt- *(Continued on page 46)*

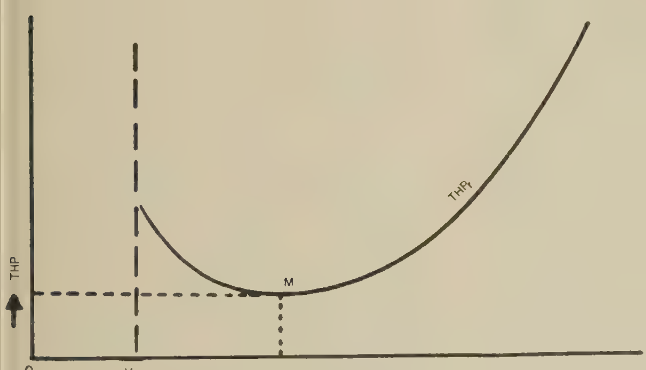


FIGURE 1

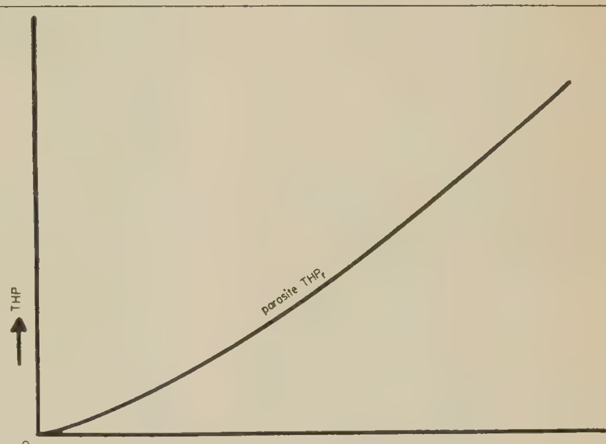


FIGURE 3

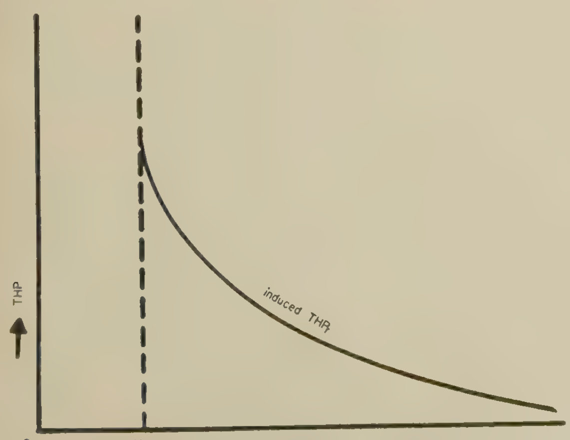


FIGURE 2

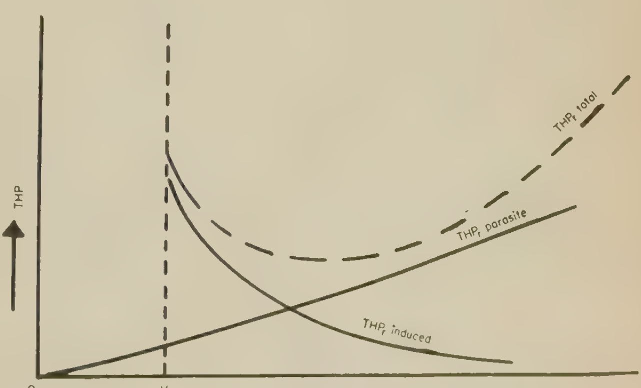
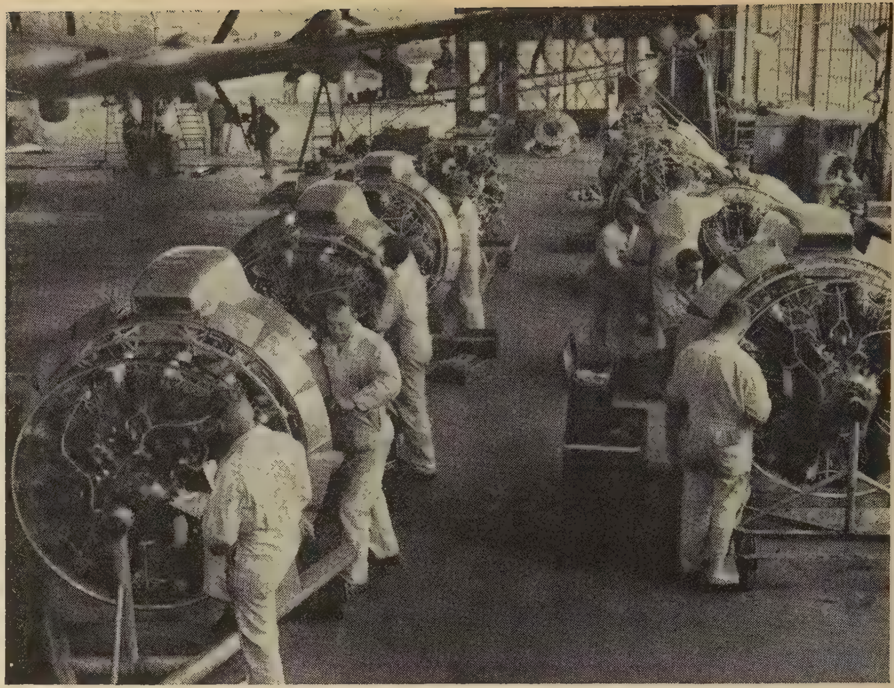


FIGURE 4

Labor Costs in Transport Overhaul



LABOR *constitutes major item of overhaul costs in relation to total cost. Overhaul labor is divided into two categories: Productive and Non-Productive. Productive labor is sub-divided into direct and indirect labor. These licensed mechanics are classified as direct*

To contract for air transport overhaul on time-and-material basis and attain low costs, a close, exacting analysis of man-hour expenditure must be made daily

by Willis L. Nye

In line with the rising cost of hourly flight operation, the overhaul cost of an air transport follows a congruent pattern. No longer may an airline or an independent transport-plane owner contract overhaul operations on a time-and-material basis and expect to attain low costs unless a close and exacting analysis of man-hour expenditure is made periodically. To be effective, this analysis must be made on a daily basis. Each day that an air transport is grounded, revenue is lost to the owner regardless of the daily plane utilization rate. Thus, the need for a precise auditing of costs is essential regardless of the kind of overhaul contract, be it on a time-and-material basis, the cost plus a fixed fee, cost plus a fixed percentage, or a flat rate basis of charging for the work performed.

Labor constitutes the major item of overhaul costs in relation to the total cost of the work performed. However, labor as a commodity must be classified into various categories, and the following can be considered as indicative of the classes of labor associated with an overhaul facility. The labor in an overhaul facility is divided into two main categories, Productive and Non-Productive.

Productive labor is further subdivided into direct and indirect labor. The former is recoverable and expendable; the overhaul facility recovers the cost of all direct man-hours expended. On the indirect labor, the overhaul facility recovers only a specific percentage of the cost in relation to direct labor expended.

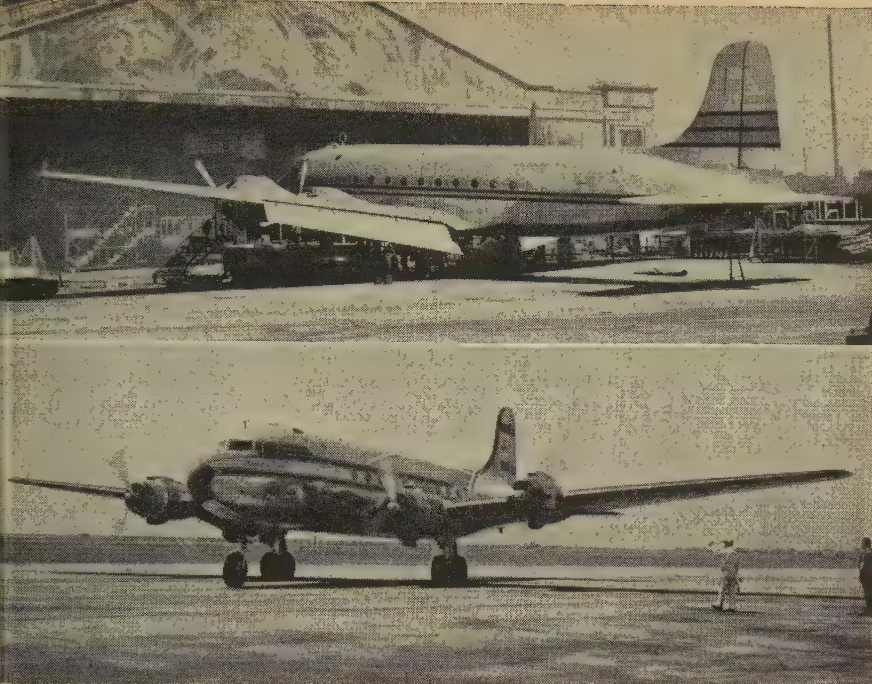
Non-Productive Labor is that which cannot be classified under direct or indirect labor. It is expendable but not recoverable by the overhaul facility and is charged as an overhead cost, administration cost, or capital investment expenditure.

The various classes of labor performing air-transport overhaul operations are as follows:

Productive Labor

	Compensation Basis
(a) *Direct Labor*:	
(1) Licensed mechanics.	Hourly
(2) Licensed inspectors.	Hourly
(b) *Indirect Labor*:	
(1) Store Room Personnel	Hourly
(2) Production Control	Salaried
(3) Training Personnel	Salaried
(4) Supervisory Personnel	Salaried
(5) Maintenance Engineering	Salaried

Non-Productive Labor	Compensation Basis
(1) Personnel and Welfare	Salaried
(2) Purchasing	Salaried
(3) Materiel	Salaried
(4) Accounting	Salaried
(5) Timekeeping	Salaried
(6) Executive	Salaried
(7) Administrative	Salaried
(8) Clerical	Salaried
(9) Plant Maintenance	Hourly



VERHAUL *in final stages of completion, these two C-54's are undergoing final inspection. he C-54 in the lower photo is being taxi-tested. The licensed mechanics and inspectors orking on overhaul are direct labor and so are compensated on a full-time hourly basis*

By a study of these classifications, is obvious that direct labor is that fort which actually produces someing within the limits of production, ich as overhaul work, fabrication, pair, testing, inspection, removal, re-installation of parts of the air ansport. Licensed mechanics and spectors are compensated on a fullme hourly basis.

But one can see that while inrect labor is difficult to assess, it tually helps to produce by aiding rect labor in a production operaon and is indispensable. For exnple, it includes work on the roduction line by parts expediting, pervision, training, salvage, sury, tooling, tool crib work, storeeper work, and personnel in other tegories. Thus, the definition of hat comprises the major divisions labor has been made, so let's see hat constitutes the yardstick of bor costs.

he Man-Hour:

The man-hour is the yardstick by hich the cost and duration of airansport overhaul operations are etermined. It is specifically defined the amount of work accomplished a skilled mechanic in one eightour working day under average ficient working conditions. It is sumed that the working conditions are efficient—the optimum condition. However, due to certain causes which are not always within control of management, it is rare that a work efficiency exceeding 66% is attainable although 100% would be optimum. One loss in time is the legitimate rest periods (20 minutes per day) which is compensatory by the overhaul facility, but which usually slows the work so that a full half-hour is actually lost. This accounts for 6.2% of the working day as lost time.

Regardless of what kind of contract is agreed between customer and the overhaul facility, it is from the estimated man-hours required to perform various reconditioning operations and anticipated materiel required that predicates the final cost. For each direct labor man-hour expended to accomplish any of the anticipated work operations, it will be possible to assess the indirect labor and non-productive labor required, in addition to the taxes on labor by the state and federal government.

Production Analysis:

In order to make an accurate report to the customer on man-hour expenditure, a production analysis of the daily labor expenditure of all categories should be available to management and customer alike. The objective of production analysis is to provide management with factual information relative to total labor expenditure and its distribution as well as the cost of the materiel expended. This information should be compiled and in the possession of management and the customer not later than 24 hours after the actual work has been accomplished. This is necessary so that corrective action, if necessary, can be taken before additional lost time accrues. However, production analytical reports, unless backed by constructive managerial action as swiftly as errors occur, will prove ineffective and merely a case history. Customers should demand such reports from the overhaul facility so that their local representatives can discuss any irregularities with management.

Relation of Man-Hours and Labor Expended:

For purposes of production analysis, the norm for labor distribution should be defined:

(1) *Productive Labor:*
   - (a) *Direct Labor:* The total direct labor expended in each working day is equal to the number of full-time skilled mechanics multiplied by eight hours which constitute a working day.
   - (b) *Indirect Labor:* The total indirect labor expended in each working day is equal to the number of full-time non-productive personnel multiplied by eight hours.

(2) *Non-Productive Labor:* The total non-productive labor expended in each working day is equal to the number of non-productive personnel multiplied by eight hours.

(3) *Total Available Man-Hours for Productive Labor and Non-Productive Labor Assignable Each Working Week:* The total of the two major categories of labor will be equal to the total man-hours expended during the normal 40-hour pay period and will consist of normal working hours, straight overtime, and premium overtime expended for labor in the two major categories. The normal work week consists of a 40-hour pay period during the seven-day work period

(Continued on Page 39)

Adequacy of Regulations for VFR/IFR Operations

Discussion discloses agreement on inadequacy of present CAR's, a need for higher VFR minima in high-density areas and the establishment of radar enroute control

William P. Person *(Consultant, Flight Safety Foundation)*: "The subject under discussion today—'Are the current air traffic control regulations and procedures adequate considering today's aircraft speed and traffic density?'—is a rather controversial one. We can't economically redesign the aircraft presently in operation, so let's accept what we have and go on from there. Let's be practical and realistic, and seek solution on the basis of what we have."

Huck Smith *(Radar Coordinator, CAA)*: "Speaking strictly from a traffic controller's standpoint, I think we have to recognize the fact that our traffic-control procedures are not suitable for handling the present densities of traffic existing in our congested terminal and enroute areas. This is particularly true along the East Coast —in the Washington, Boston and New York areas. The same also holds true for Chicago. There has to be an answer in order to eliminate delays to aircraft, and the ultimate answer probably will be full radar traffic control, enroute systems as well as terminal. We haven't as yet come up with a piece of radar equipment that will give us full coverage along our enroute airways, but we hope to eventually implement radar traffic control along the congested airways, particularly the East Coast. There are plans underway wherein we may be able to make use of the air defense radar, and thus be able to apply radar separation enroute between terminals as well as in the terminal areas proper.

"As far as handling traffic at the terminal points is concerned, we have implemented a traffic control system at Washington which has enabled us to about reach the saturation point of the airport. However, that isn't true in the New York metropolitan area—we have to have additional equipment in order to implement a full radar traffic control system here. It will require additional repeater scopes and more space in which to place this equipment; it probably will call for IFR rooms both at Newark and LaGuardia, and right now we have neither the space nor the equipment to fully implement such a radar program."

William Person: *"Let's see how the pilots feel who fly the line every day. Capt. Van Liew, what have you to say about this?"*

Capt. Harry Van Liew *(Pres., Executive Air Transport Co.)*: "First of all, I'd like to go on record with the fact that CAA and ATC are doing a wonderful job. I've watched the growth of ATC since those days in 1931 and '32 in Chicago when the radio operator would contact you and report that flight such-and-such was going to be in the Chicago area at a certain time and would be flying

VFR/IFR ROUND TABLE *participants (left to right around table) Huck Smith, CAA Radar Coordinator; Capt. John Gill, Eastern Air Lines; Capt. J. D. Smith, Capital Airlines and ALPA Regional Safety Chairman; Capt. L. M. Holloway, Pan American; Capt. Kim Scribner, Pan American; Herbert Fisher, Port of N.Y. Authority; Capt. Harry Van Liew, UAL and Pres., Executive Air Transport Co.; Max Karant, Gen. Mgr. AOPA; B. J. Malloy, Asst. Chief Pilot, Swiflite Corp.; Moderator William P. Person of Flight Safety Foundation; Bennett Horchler of SKYWAYS; Thomas Davis, CAA; and John Quinn, Chief, Gen. Rules, CAB*

WM. P. PERSON, who served as Moderator of discussion, is a consultant on staff of Flight Safety Foundation and former AAL pilot

instruments. Pretty soon, you'd discover somebody had made a mistake someplace because you'd suddenly come face to face with a very peculiar turbulent condition. Then, when you came out of the overcast and made your approach, you'd find that you'd been flying a slip-stream all the way down! We've certainly made great progress since those days.

"I have some notes here on what I think is wrong with this business of flying the high-density areas, and Number One is the integrity of the pilot himself. There's too much of this business of the prima donna pilot in the airplane. We must do something to make pilots honest in their reporting. Apparently, we can't get away from competitive flying . . . you report over Allentown, for example, at 22 and you're told to be at 11,000 feet. So you hit 11,000 feet at 22 after the hour, and you hear another airliner report over Allentown at 21. You look all over above the overcast and you can't see the other plane anyplace. Then you find yourself holding at Matawan or Flatbush. Eventually, you discover that this particular prima donna who reported a minute ahead of you is actually five minutes behind you!

"Now, you've got differentials in speed. You have airplanes coming in under instrument conditions at 130 mph and you have them coming in at 330 mph. If we're going to have that kind of speed differential, the CAA is going to have to lower the boom on this honesty department in reporting. Pilots simply have to report where they are and at the time they really are over the fix.

"If nothing can be done along the honest-reporting lines, the next thing to do is to control speeds when you get within 75 miles of a high-density area such as New York. The speed should be 150 mph at such-and-such

"REGULATIONS *as they stand now are not adequate," reported J. D. Smith. "Enroute, the 500-on-top is a joke." Capt. Holloway (sitting on Capt. Smith's left) joined others in agreement with Capt. Smith's statement*

"PILOTS *must be more honest in their reporting," stated Capt. Van Liew. "There is too much of this prima donna pilot who reports a minute ahead of you when he actually is five minutes behind you"*

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

MARCH 1954

Wings Club
New York, N. Y.

Round Table Participants

NORMAN R. (HUCK) SMITH began his traffic control career in 1940. He was Chief Controller, Chicago, '47; now is Radar Coordinator (N.Y.)

JOHN F. GILL, Chief Pilot-Eastern Region, Eastern Air Lines, starrted flying in early 1920's and joined Eastern Air Lines in November, '30.

J. D. SMITH, a Capital Airlines' captain, is also Regional Safety Chairman of Air Line Pilots Association. He joined Capital in 1945.

L. M. HOLLOWAY is Sector Chief Pilot, LAD, Pan American World Airways. Capt. Holloway took up flying in '36, now has 12,000 hours.

KIM J. SCRIBNER, Chief Pilot-Atlantic Div., Pan American, studied engineering at Maryland University. He became Div. Chief Pilot in 1951.

HERBERT O. FISHER spent 14 years as engineering test pilot for C-W before joining Port of N.Y. Authority as Chief, Aviation Develop.

HARRY R. VAN LIEW, a United Air Lines' captain, is also president of Executive Air Transport Co., an aviation consultant organization.

MAX KARANT, Asst. Gen. Mgr. of Aircraft Owners and Pilots Association, is experienced pilot and spokesman on personal plane problems.

B. J. MALLOY joined Swiflite, a subsidiary of Cities Service Co., in 1947 and is now assistant to George Pomeroy, Chief Pilot and Gen. Mgr.

T. A. DAVIS spent four years with the Air Force and joined the CAA in Region 1 in 1939. He is now Chief of General Safety Branch of the CAA.

JOHN J. QUINN, Chief, General Rules Div., Bureau of Safety Regulation, CAB, an experienced pilot, both civil and military; joined CAB in '42.

"SINGLE-ENGINE AIRCRAFT *are increasing in reliability," stated Mr. Davis of CAA, "and businessmen are realizing it. Consequently, larger populated areas are beginning to feel increase in small business aircraft. Traffic control must consider these small aircraft"*

a time and you hold to that speed. The DC-3's and the Beechcrafts can go along at an Indicated 150, and the airlines can hold to that speed, too. In other words, control power—and that means precision flying.

"There's a lot of laxity in flying the courses, even with the VOR's and all the aids that we have. You see it all the time. Pilots are supposed to be at one side of the course; instead, you find them way over on the other side. The CAA says that our surveillance radar is not a "police" instrument, but I think we're going to have to make examples of these guys and make them realize that they have to do a precision job of flying.

"Number three, pilots should have a more practical and an increased knowledge of meteorology and its application to air traffic work in the high-density areas, and not have to rely so much on the meteorologists and forecasters. ATC, too, should avail itself of the practical aspects of local conditions. For example, coming in from Chicago this morning, there was a light northwest wind, scattered clouds and wonderful visibility. LaGuardia was giving 15- or 20-mile visibility, ceiling and visibility unlimited. Yet when you got down to the lower levels with the inversion that existed today, that light northwest wind was blowing all the smoke from Newark and Bayonne down into the Flatbush holding area. A pilot who doesn't know this area intimately files a VFR flight plan, LaGuardia is wide open, but when he gets down to 2,000 feet, he gets into this smoke area where he has just ¾-mile visibility. That's a dangerous situation.

"Another thing, I think there are a lot of pilots flying today who do not know the CAA rules and regulations. They have them in their operation manuals, but they do not have a clear-cut working knowledge of the CAA rules and regulations."

William Person: *"You've given us honest opinions, Harry, and that's what we need to get to the solution of the problem. Max Karant, what have you to add to the discussion?"*

Max Karant *(Asst. Gen. Mgr., AOPA):* "I came to this meeting fully expecting to be bounced around quite a bit because of the type of pilot I represent. Frankly, however, I haven't heard more refreshing comments than those of Capt. Van Liew. I agree with him completely, not only from the standpoint of airline pilots but also from the standpoint of other pilots in general who fly the civil airways. Half of our battle is won if enough of us would be honest and recognize these things and try to do something about them among our own people. My tendency, of course, is always to discriminate sharply between VFR flying and IFR flying. I believe most of the time Capt. Van Liew was speaking in terms of an IFR operation. Am I correct?"

Capt. Van Liew: "If I may interrupt for a second . . . In this day and age, an awful lot of people are operating under a false security in this IFR business. Too many times I've seen pilots file an IFR, take off and go some 2,000 miles. He may have an IFR condition for the first 1,000 miles and then have 1,000 miles of VFR. He sits up there fat, dumb and happy, thinking he's got protection in that IFR clearance when there may be many, many pilots enroute in his own locale that are operating under VFR conditions. It's a false security that exists in the IFR clearance."

Max Karant: "I've had that very discussion with a number of airline and other professional pilots and, to my amazement, I have found a number of intelligent men who think they actually have protection. When I ask them if it isn't conceivable under the law that when they report over a certain range station at a certain altitude, there could be a thousand other airplanes at the same place at the same time, they say, 'Well, I never thought of it that way.' It usually turns out to be a rather frightening thing to contemplate.

"To be very radical about this, sometime ago we advocated to the CAB that they study very carefully the possibility of forbidding the filing of IFR flight plans under VFR conditions. That kicked up quite a storm of interest. Nevertheless, there have been so many incidents involving pilots who *thought* they had protection when they didn't, that it began to look like a serious problem. I'm very happy to hear that the airline people are inclined to agree with that.

"The one point I would like to make concerns Capt. Van Liew's statement that pilots should be better meteorologists. What you are asking a non-professional pilot to do is to become adept at a very exacting science and he can't do it. You'll find that the best meteorologists among pilots are those who've had the devil scared out of them by weather. They've learned the hard way.

"You might be interested in a report released in Washington recently. A committee was appointed to study the performance of the Weather Bureau as far as aviation weather was concerned. This committee reported very clearly that in its opinion the Weather Bureau was 8 or 10 years behind the times in its handling of aviation weather, and the committee suggested that the whole thing be thrown out of the window and we start all over again. I couldn't agree with that committee more. AOPA appeared before the committee and,

believe, there were some airline meteorologists on it.

"Weather reporting is a very serious problem and I think that if we can do something about the weather, we'll have a healthy and big industry. However, I do not see how you can turn the average man who flies into any kind of a meteorologist. The men on the ground who are trained and paid to do that work logically should be expected to deliver the goods to at least a safe degree. I agree that they don't a lot of times."

Huck Smith: "Since there has been considerable discussion regarding VFR flight, weather, etc., I would like to quote from the minutes of a meeting held in a Regional office which was attended by representatives of the airlines, the ATA and ALPA. This meeting was relative to the use of 500-on-top as used in an IFR clearance. I quote as follows:

"'There is no traffic separation being provided between an aircraft operating 500-on-top and an aircraft operating VFR, or between aircraft operating 500-on-top and other aircraft operating on an approved instrument flight plan at assigned altitudes. Therefore, assignment of 500-on-top, a controller constitutes a derogation of aircraft separation service request by a pilot in the filing of an instrument flight plan.

"'The pilot with his pre-flight weather analysis, enroute weather reports and a correct observation of weather conditions is the one man in a position to determine whether or not he needs traffic separation.

"'The controller in the center of the tower is not supplied with nor can he be equipped with weather information adequate for consistent application of 500-on-top, either on his own initiative or to a pilot's request, its inclusion is a condition to an instrument clearance.'"

Capt. John F. Gill *(Chief Pilot, Eastern Airlines)*: "The regulations as they stand today are about as good as you can get. If additional regulations were needed, they would have been forthcoming long before now. It's a simple case of attempting to cram a quart into a pint bottle. We are not effectively utilizing our airspace in high-density terminal and enroute areas. The antiquated methods used to control traffic separation require large amounts of airspace and are not as effective nor as safe as more modern methods. There is

"MID-AIR COLLISION *problem is of vital concern. Airline pilots feel that we will not have real air traffic control," reported Capt. Kim Scribner (right), "until we have control over VFR operations on the airways. We can't rely on just the scope of visual reference"*

a real need for better enroute and terminal traffic separation and control and, to my mind, the answer is radar. The more difficult problem of the two is the terminal area. No one who flies into Washington can find much fault with the way radar traffic control is operating there today. New York, however, leaves much to be desired. It appears to me there should be little difficulty in implementing enroute radar traffic control. Flights are routed all around Robin Hood's barn when entering or departing terminal areas, whereas enroute it's mostly a straightline proposition.

"Between New York and Washington, I believe we now have good radar coverage, and I for one would like to have enroute radar traffic control implemented at the earliest date on this, the heaviest traveled airway of the world.

"Capt. Van Liew mentioned airspeed differences. Obviously, the airlines, being in the air-transportation business, want speed. But I agree completely with Capt. Van Liew. Once we get into, say, the yard limit, then a common speed is required in order to effectively feed the runway."

Capt. Van Liew: "You should set a particular speed that would fit the majority of aircraft so that ATC will have better control of the aircraft as they come through the approach and holding patterns."

Capt. John Gill: "That idea already has passed through the Chief Pilots Committee of ATA. The suggestion was that at a point 30 or 50 miles out airspeed would be reduced to 180 mph, and in the final stretch, to 150 mph. I'll be the first to say that radar approaches are being fouled up in many places due to the large differences in airspeed. On a radar scope, when someone comes batting along at 300 against another plane's 150, the controllers have great difficulty trying to maintain a rate of flow and safe separation. Therefore, there is little question about the nenecessity of a 'yard speed' in the final terminal area.

"As to meteorology, I agree that pilots should have a good working knowledge of the subject and particularly local weather conditions. However, I doubt if there's a pilot on Eastern who would think for one minute, flying IFR or VFR, that he was being afforded any protection from other traffic except known IFR.

"Regarding this business of a local smoke condition fouling up a pilot in the Flatbush pattern, I think the whole problem narrows down to an urgent need to expand the radar traffic control program and to include enroute control as well. Once we do that, the airspace can contain many more aircraft than it does today, and it would be a safer operation."

Capt. Van Liew: "I'd like to ask a question relative to radar. Let's say between Phillipsburg and Allentown you have 50 airplanes flowing into the high-density area of New York City. What sort of provision has been made for identifying these aircraft?"

(Continued on page 31)

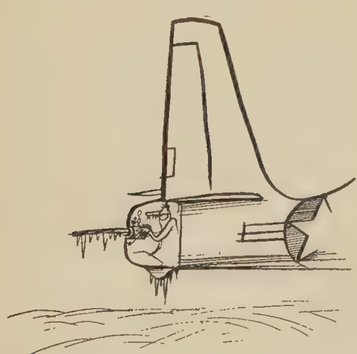
Performance PITFALLS

from the Files of the Flight Safety Foundation

by Jerome Lederer and Robert Osborn

AVIATION VS. PUBLIC PRIVACY

One of the most basic of human freedoms is the one pertaining to the privacy of one's own home. Aviation is the only form of transportation which can invade that privacy. If the person is injured or killed by other form of transportation, he has to contribute in some way to his own destruction, *e.g.* the pedestrian has to take a walk or a ride to become the casualty of an automobile. This psychology of the people in their homes overwhelms all statistics about passenger-miles safely flown and mutes all favorable evidence on the side of air transportation and airplanes. Few people have been casualties as the result of aircraft falling on them, but it is the cry of the people on the ground near the accident rather than the people actually involved in the airplane itself, which closes the airports!



FLYING FATIGUE

In discussing flying fatigue at a meeting of the Aero Medical Association, Dr. Gilbert L. Adamson reported, "The principles of our knowledge of fatigue in air crews are important in peace, and doubly important in war. In summarizing the reactions to flying which may reasonably be considered under the heading of fatigue, there are two general types:

"1. The type of fatigue experienced in long, dull flights where there is no particular danger or any need for constant alertness, although considerable tension may be involved. In such instances, fatigue is heralded by a feeling of boredom, relaxation and drowsiness. This state is *induced* by sitting in one position, a lack of visual stimulation, the lulling effect of the continuous noise of engines, and warmth. It is *combated* by movement about the aircraft, temperature control, hot fluids every hour, and hot food every four hours. Benzedrine or simular stimulants may be useful at times.

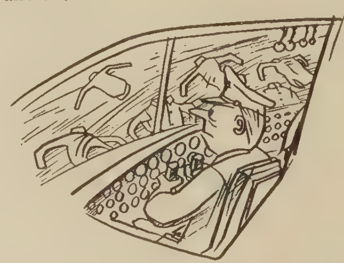
"Measures to counteract flying fatigue are aided by the maintenance of high crew morale which, in turn, is fostered by provision of clothing best suited to such conditions, suitable food and drink, the proper spacing of flights, suitable aircraft heating and proper sanitary arrangements in aircraft.

"One of the most important factors is a feeling among the crewmen that everything possible is being done to make tedious flights comfortable. Certainly a potent factor in producing excessive fatigue in long flights is an unforeseen delay in take-off.

"2. The second general type of fatigue is that encountered in flights at high speed wherever excessive watchfulness and quickness necessitate a constant state of alertness. This state introduces the element of stress beyond that which is involved in merely doing a 'job'. This kind of stress consists of two elements—the strain of constant alertness and the associated anxiety that is inherent in any hazardous undertaking. Prolonged concentration is fatiguing in itself and the added anxiety imposes definite limitations of service."

EXPANSION OF GASOLINE

Like most things, gasoline expands with rising temperature. Remember this when you are refueling ground equipment and don't fill tanks brim full, particularly if the equipment is apt to be left standing several hours before being used. Ten gallons of gasoline in a tank filled with cool fuel may expand as much as a quart if left standing in the sun. Overflowing gasoline is not only wasteful, it's also a fire hazard. So . . . leave a little room for expansion.



WHITE SHIRTS

Wearing a light-colored uniform shirt in the cockpit could cause trouble, according to word received from an airline senior captain. He reported,

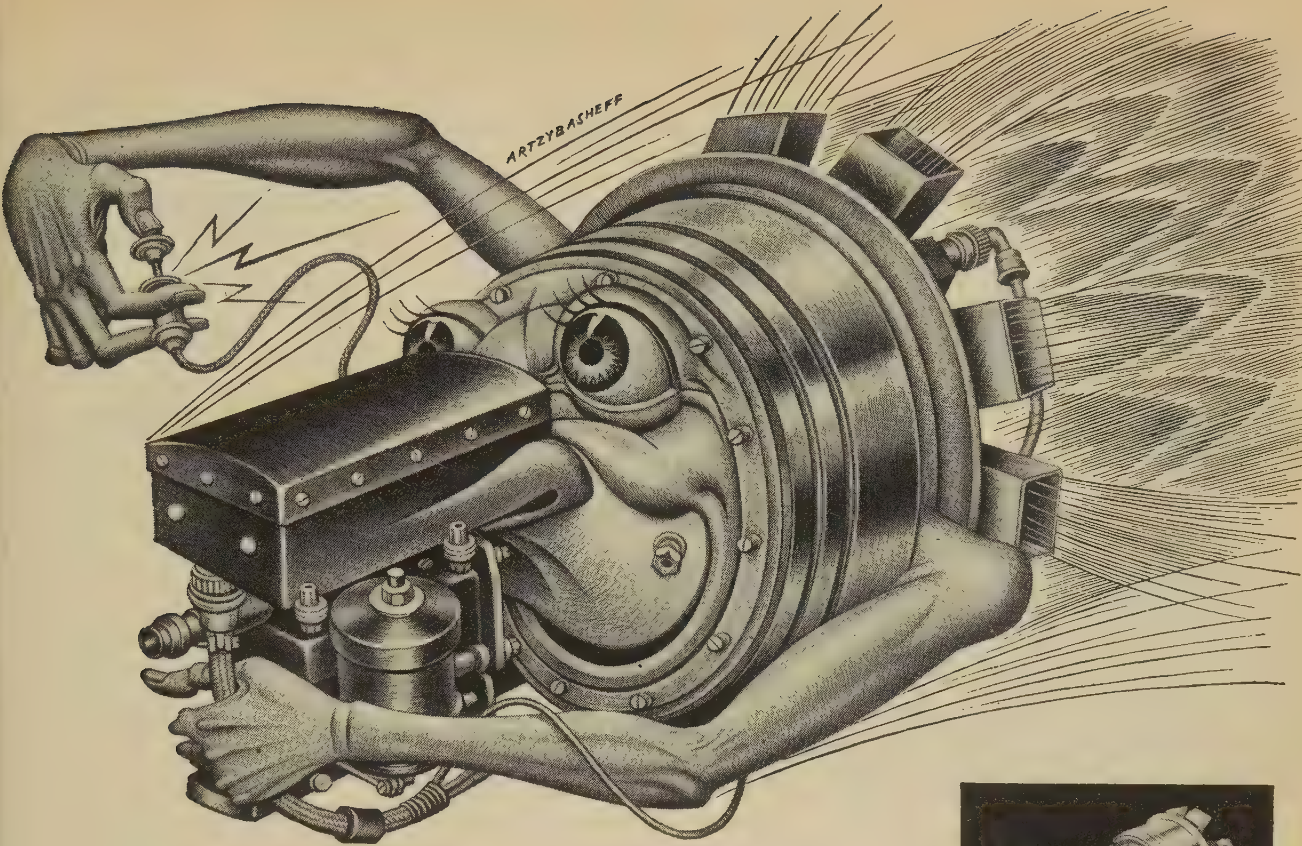
"I have often noticed the reflection of a copilot's shirt in the windshield and on some occasions have mistaken that reflection for clouds, particularly at night and, under certain conditions, during the day. With aircraft closing in on each other at speeds of several hundred miles per hour, nothing which might interfere with vision should be worn in the cockpit."

A GLASS OF BEER

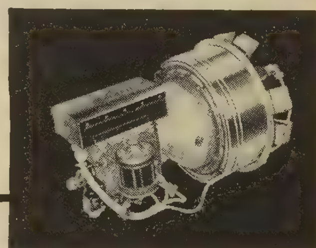
At a training center of the Danish Air Lines in Copenhagen, a number of pilots volunteered for tests of the effects of alcoholic beverages on their flying ability. After partaking of drinks of varying alcoholic content, the pilots were subjected to special routines in Link trainers to determine reaction time and other factors. The tests showed that even a small glass of beer produced measurable results.

KEEP UP-TO-DATE

Referring to a two months old *Airman's Guide*, a pilot picked out an airport in Texas to land on. With three passengers, he brought the plane down. But not until he was rolling across the ground at a speed of 35 mph did he notice several drainage ditches had been cut across the landing strip. The current issue of the *Airman's Guide* listed the airport as abandoned. *Question:* Why trust a $15,000 airplane and four lives to an obsolete *Guide?*



Parts that put new "starts" in jets

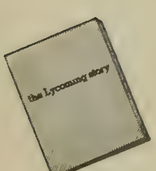


For 14 major components of the first mass-produced self-contained starter ever built into large jets, Bendix Aviation looks to Lycoming for precision production.

Good news for new-born jets! This typewriter-size Bendix Aviation self-starter is *built-in* . . . develops 340 horsepower in just 3½ seconds . . . enables a jet's main engine turbine to reach take-off speed in a matter of seconds after the pilot hits the starter. No more precious minutes lost while ground crews bring up mobile auxiliary starting power!

For 14 of the rugged, dependable, precision-machined parts that make up this self-starter for jets . . . Eclipse-Pioneer Division of BENDIX AVIATION CORPORATION looks to Lycoming.

Do *you* need precision parts . . . or any other of the diversified services listed with our signature? Lycoming's wealth of creative engineering ability . . . 2½ million square feet of floor space . . . and 6,000-plus machine tools stand ready to serve you. *Whatever* your problem . . . *look to Lycoming!*



Just off the press! "THE LYCOMING STORY". . . 40 interesting, illustrated pages showing many ways Lycoming is ready to help you. Write for it on your letterhead.

Aircraft Engines
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LOOK TO **Lycoming**

DIVISION OF AVCO MANUFACTURING CORPORATION STRATFORD, CONN.
Manufacturing plants in Stratford, Conn., and Williamsport, Pa.

AIR TRACTOR—*Large gap and stagger for increased lifting efficiency are evident in this photo of new dusting and spraying plane. Spill plates at tips increase effective aspect ratio*

New Duster-Sprayer Completes Its Engineering Flight Tests

Yakima, Wash. A new airplane specifically designed and built as a duster-sprayer recently completed its intensive engineering flight test program. The Central-Lamson Corporation's *Air Tractor* is a "big, square" biplane powered by a 450-hp Pratt & Whitney Wasp Jr. It has the wing span of the standard Stearman duster, but is longer and sits higher than the Stearman.

Test pilot James A. Clark, who put the plane through its paces in the test program, termed its performance "excellent in every respect."

All test flights were made under conditions of simulated or actual load. Carrying a 2500-pound load off Yakima's hard-surfaced runway (altitude—1,070 feet; wind—zero to 2 mph; temperature—50°F), the *Air Tractor* got away in slightly less than 1,000 feet, climbed at 450 fpm for 2,000 feet after take-off, and then landed (fully loaded) in 950 feet (full stop). Carrying a spray load equivalent of 1500 pounds, the duster sprayer got off in 410 feet, and landed (fully loaded) in 350 feet.

According to its designers, the key to the performance of the *Air Tractor* lies in its high-lift airfoil.

Quality Control Program Initiated by The Babb Co.

Newark, N. J. To enable purchasers of used and surplus aircraft parts and assemblies to predetermine the value of such parts before purchasing, The Babb Company has started a quality control program. Objectives are to do away with the confusion that presently exists in the listing of the conditions of such materials, and to make it possible for the prospective purchaser to relate the condition of the materials to the price and thus determine the true value of his purchases.

Under the new plan, material offered by Babb will be sold in one of the following conditions:

Factory New Certified: This classification means that the part is of recent manufacture and meets the manufacturer's current specifications and standards.

Unused Certified: Such parts are unused but not of recent manufacture and will be inspected and certified as to airworthiness before being sold.

Unused Overhauled Certified: This denotes material not of recent manufacture and, due to long-range storage, it is necessary to replace seals, packings, bearings, etc. to return it to its original new and airworthy standard.

Used Overhauled Certified: Signifies a used part which has been completely disassembled and thoroughly overhauled to manufacturers' and CAA specifications. All mandatory modifications will have been accomplished.

In all of the above four classes CAA Certification will be given confirming the condition under which it is sold. It should be noted that CAA Certification is only applicable to airborne equipment. The Babb Company will give its own certification on ground and test equipment not CAA certifiable.

New Aero Commanders Delivered for Use by Business Executives

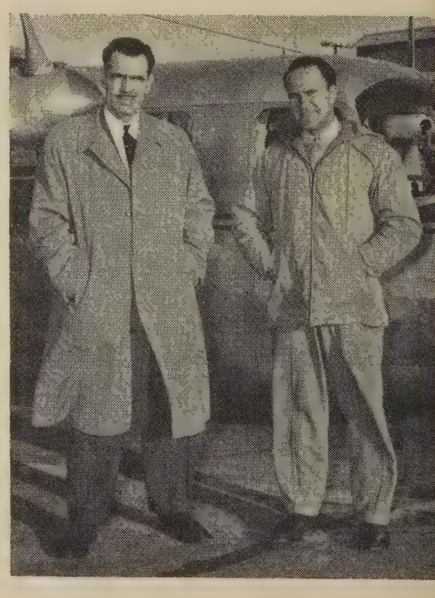
Bethany, Okla. The business skyways of the nation are becoming increasingly populated by Aero *Commanders*, judging from the list of recent purchasers of this twin-engine light transport.

Clemson Brothers, Middletown, N. Y., have operated aircraft for business for many years, and recently added a five-place *Commander* for executive transportation. Piloted by Lloyd Yost, the airplane was christened "Star IX", marking the ninth transport aircraft to have been used by Clemson Brothers through the years.

Carleton Putnam, Chairman of the Board of Delta-C&S Airlines, is now operating a *Commander* in connection with his activities with the airline. Mr. Putnam holds both an instrument and multi-engine rating and is flying throughout the South and East in his work with Delta-C&S' numerous branch offices. He reports he expects to log over 400 hours this year.

Another purchaser was Charles E. Scripps, Chairman of the Board of the Scripps-Howard Trust. Mr. Scripps is using the plane to maintain a closer contact with the many Scripps-Howard newspapers throughout the country. Other publishers that are also operating *Commanders* are Col. McCormick of the Chicago *Tribune*, Charles Lamb of the Erie (Pa.) *Post-Dispatch*, and the Asahi Press in Tokyo.

Air Associates, distributors of aircraft products and supplies, also took delivery of a *Commander* to be used as an executive transport. The plane is based at Teterboro, N. J., and serves as a transport for executives traveling to Air Associate branch offices in Glendale, Cal., Chicago,



COMMANDER *was delivered to M. Parks and Herb Ackerman for Air Associates' use*

)allas, Atlanta, Miami, Hackensack and)range, N. J.

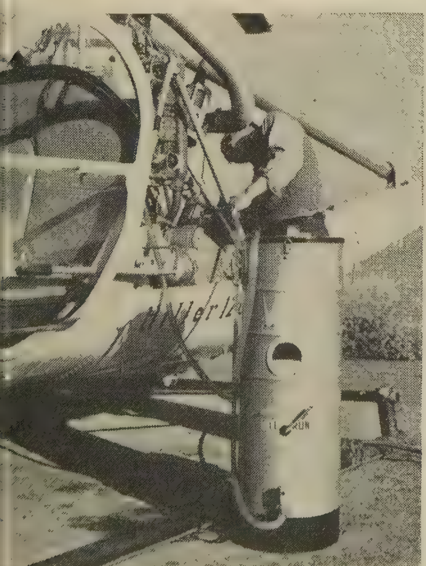
Newest feature, included as standard equipment on the *Commander,* is a power-teered hydraulic nosewheel. Referred to s "Tip Toe" steering, it operates in con-nection with the hydraulic braking system. When retracting the gear, an automatic centering device in the nose steering cylinder straightens the nose gear, permit-ing it to enter the nosewheel well in a centered position. The hydraulic steering cylinder also performs the dual role of serving as a nosewheel shimmy damper.

Combustion Chamber Cleaner Reduces Plane Maintenance Costs

Palo Alto, Cal. Thanks to a new device now being introduced to the aircraft in-dustry, it is possible to thoroughly clean the combustion chambers of aircraft en-gines without removing the cylinders. De-veloped and manufactured by Kent-Moore Organization, Inc., of Detroit, the "Com-bustion Chamber Cleaner" blasts clean the combustion chambers through the spark plug ports with a special non-abrasive and non-corrosive material. This blast material is introduced at high velocity through an adjustable nozzle which screws into one spark plug port, and the waste material and foreign deposits are recovered through an adapter attached to the other port.

The new machine is an outgrowth of machines using the same principle which have been proved over a period of several years in the automotive industry. Tests of the cleaner at aircraft manufacturing plants and in the field have proved its operating simplicity and its effectivity in restoring combustion efficiency and reducing mainte-nance costs. These same tests have indi-cated that as little as five minutes per cylinder is all that is required to accomp-lish removal of carbon and other combus-tion residue.

The "Combustion Chamber Cleaner" is being marketed by Rice-Peterson Sales, Inc., Palo Alto, California.



COMBUSTION *chamber cleaner is shown here in operation on a Hiller H-12 'copter*

....in the Business Hangar

Superior Oil Company has had its *Lodestar* N-17639 at Lockheed Aircraft Service, Burbank, for tank and miscellaneous servicing.

Bob Neel and Ben Duhon brought the Brown Paper Mill's DC-3 to Execu-tive Aircraft Service, Dallas, for 100-hour inspection and various repairs. Also at EAS is the S. W. Richardson DC-3. Chief Pilot Ed Armstrong flew the transport in for 100-hour inspection, miscellaneous repairs and installa-tion of Sperry A-12 autopilot.

Timken Roller Bearing Company's B-25 is back in operation after get-ting a completely new executive interior, installation of wing tip gas tanks and new radio installation. The work was done by AiResearch Aviation Service at Los Angeles.

Lewis M. Leach, Jr., chief pilot of American Export Co., and Dick Riemer, navigator, recently flew a *Mosquito* bomber from Sydney, Aus-tralia to Burbank, Cal. This is the first of 10 de Havilland *Mosquitos* to be ferried by Aviation Export from Sydney to Burbank. The bombers are to be converted for high-altitude aerial survey work.

Skip Wittner, chief pilot for Kewanee Oil Company, is back in the air with his company's Super DC-3. The plane was at Remmert-Werner for installation of Sperry H-5, a Sperry A-12 autopilot, a Bendix TA18BB and Collins 51R3 standby VHF communications transceiver. Kewanee Oil is a member of NBAA.

The Hunkin-Conkey Construction Company's de Havilland *Dove* is un-dergoing a completely new radio installation. The work, being done by Dayton Aviation Radio and Equipment Corporation at Dayton's Cox Muni-cipal Airport, includes removal of the old equipment and installation of Collins 17-L and ARC T-11 transmitters, Collins Course Line Indicator, dual omni, Collins 51R3 receiver and 51V1 Glideslope, Eclipse-Pioneer flux-gate compass system, ARC F-11 isolation amplifier and a Bendix MN-62 radio compass. The *Dove* also is getting a custom-built instrument panel, plastic-insert lighted radio and pilot-copilot audio selector panels. Hal Muny is Hunkin-Conkey's chief pilot and NBAA representative.

Southern Aero, Inc., of Atlanta, Ga., has added a Flite-Tronics CA-1 audio distribution amplifier to its Aero *Commander.* Installation was done by Aircraft Electronics Co., Atlanta.

Capt. Cal Readinger and his copilot Bob De Hart had Willson Products' Twin Beech at Reading Aviation Service for a double engine change. A radio monitoring system and inter-communications also was installed in the cabin so that the passengers can keep track of cockpit activity.

Hardman Tool and Engineering Co. has brought out a new line of execu-tive equipment and chairs for the *Learstar.*

Harvey Glass, chief pilot for Texas Illinois Pipeline Co., and his copilot, Bob Weber, have their DC-3 (called "The Tex Illiner") at Northwestern Aeronautical Co., Holman Field, St. Paul. Pratt & Whitney R-2000 engines are being installed to replace the 1830-92's. Northwestern Aeronautical is using engineering data supplied and developed by Pan American World Airways and Pan American-Grace Airways. The R-2000's will give the DC-3 increased performance and speed. Mr. Glass is Texas Illinois' NBAA rep-resentative.

Horton and Horton Upholsterers inaugerated activities in their new lo-cation at Meacham Field, Fort Worth, with a "custom-deluxe" interior of red and white genuine leather in an Aero *Commander.*

Bob Myers has Joyce Lumber Company's *Mallard* at Remmert-Werner for a double engine change, new interior and a new exterior paint job. Joyce Lumber's NBAA representative is Mrs. B. J. Kean.

Official NBAA Report

NATIONAL BUSINESS AIRCRAFT ASSOCIATION, INC.

(formerly Corporation Aircraft Owners Association)

National Business Aircraft Association, Inc. is a non-profit organization designed to promote the aviation interests of the member firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable business aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. NBAA National Headquarters are located at 1701 K Street, N. W. Suite 204, Washington 6, D.C. Phone: National 8-0804.

Nat'l Interest Demands Single Navigation System

In light of the present controversey between civil and military organizations concerning the adoption of the Navy-sponsored TACAN System of air navigation, the following common system concept should make interesting reading. It was first stated in a Department of Defense report published in March, 1948. This report recommended the development of a common military/civil system of air navigation and air traffic control. It stated that such a system should be developed and that: "The Common System requirements represent the greatest extent to which one set of requirements can be made to serve the purposes of *all* users in the interests of the national welfare and security. A system built to satisfy these requirements will meet the requirements of non-tactical military aviation. It will satisfy some, but not all, of the requirements of tactical military aviation."

ANDB and National Security also stated: "(a) *Air Defense and Traffic Control:* The air defense of the United States, as well as effective traffic control, requires that facilities for observing, identifying, and controlling aircraft movements within strategic boundaries be established and maintained in continuous operation. Implicit in this requirement is the need for a network of surveillance radars whose location is primarily determined by air traffic requirements but which will be available for military purposes insofar as of value. These radars should be interconnected by communication links, and should have information and control centers. The network of surveillance radars should not be confused with proposed early warning systems, but should be capable of integration with any early warning system established. In the event of attack, it could be immediately included in the air defense system by reason of its operational readiness resulting from continuous peacetime employment. Moreover, it would provide a group of trained operational and maintenance radar personnel available for defense purposes at no additional cost to the defense budget.

"(b) *Readiness:* The types and speeds of air weapons available to an enemy make possible such rapid and powerful attack on the United States that it is of major importance to our national security to have an integrated air navigation, traffic control, and warning system in a state of readiness. In time of emergency, some or all of civil transport aviation may, of necessity, be made available for military transport purposes since military air transport capacity, alone, may be inadequate to the demands for rapid air cargo and personnel transportation. The system might even be called upon to support the tactical air operations necessary to repel enemy attack within the continental borders of this country. Readiness requires that the system be kept in use so as to maintain both personnel and equipment efficiency; in time of peace, economy dictates that the air navigation and traffic control system be utilized for commercial needs as well as military training and transport."

The report concluded that: "There appears to be no major differences between the requirements for civil transport and non-tactical military transport operations. However, equipment limitations, necessity for detailed ground command and direction of air combat units, and other factors, create special requirements for tactical military operations which cannot be met fully by any efficient Common System, no matter how adequately it might satisfy non-tactical military and civil requirements."

Certainly, the national interest demands that a single basic system of air navigation and air traffic control—a truly national common system which will satisfy the requirements of *all* military and civil users to the greatest extent feasible—must be developed and installed. The system must provide for all weather operation, at all altitudes, of civil transport and military aircraft alike, and must provide a maximum service to the operators of small aircraft, and to special types of aircraft such as helicopters and convertaplanes, permitting them to make maximum use of their unique characteristics. Where necessary, the system must be complemented by aids to meet special requirements of tactical military aviation. The system also must be capable of instant integration with the air defense system of the United States so that it will constitute an auxiliary to the air defense network in a constant state of operational readiness. The research and development for this system is, and will continue to be, conducted by the joint military/civil Air Navigation Development Board, which was established by the Secretaries of Defense and Commerce in 1948 as the instrumentality for achieving the above objectives.

With nearly 60 million dollars presently invested in VOR and DME, as well as 10 years of research and development, the abolishment of the civil common system would represent a huge financial loss to the taxpayers if TACAN (which is still cloaked in military secrecy) was accepted as the new system. NBAA has checked and found that approximately 19,000 VOR receivers are presently being used in civil aircraft, which in cold hard cash amounts to approximately 18 million dollars worth of equipment that would have to be junked in favor of the TACAN system. In addition, the heavy investments of funds in air navigation equipment by various commercial manufacturers would be jeopardized and result in severe financial set-backs.

Member Cited for Excellent Maintenance of its Aircraft

Sprague Electric Company's Flight Department has been cited by the Beech Aircraft Corporation for excellent maintenance of its aircraft. The Company is one of 36 firms and individuals so honored by Beech in announcement of its first annual Beechcraft quality control awards.

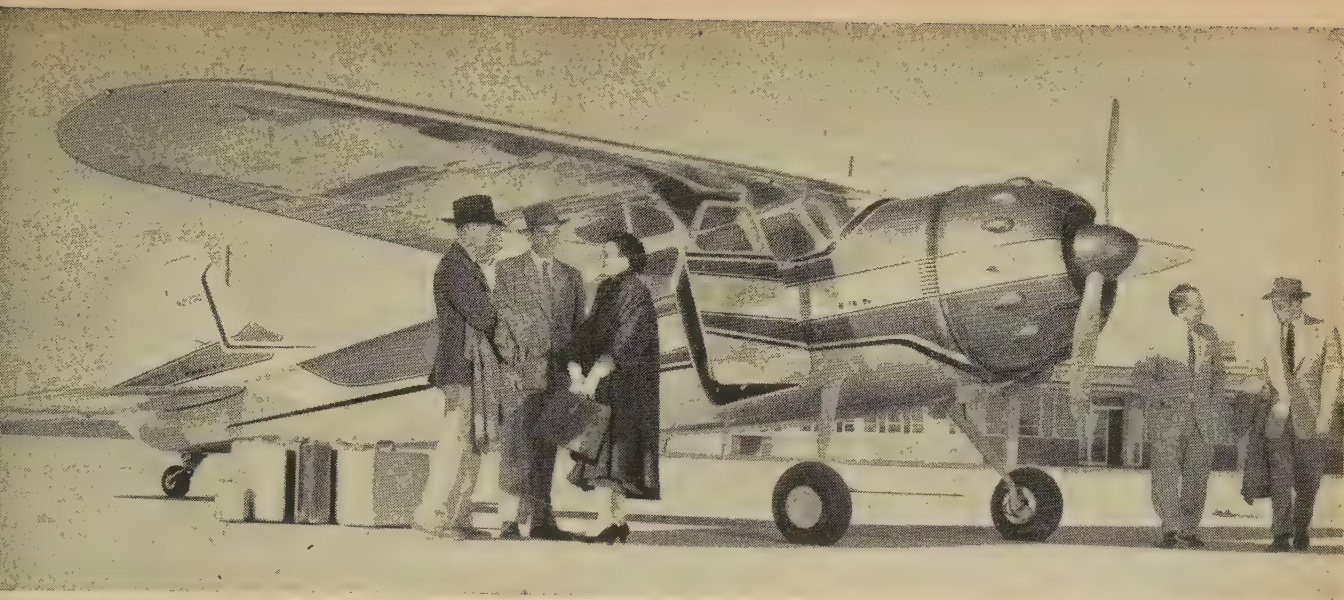
The Company has received a certificate in recognition of its distinction. Sprague Electric's Flight Department operates two Beechcraft *Bonanzas* and one Twin Beech, based at Harriman Airport, North Adams, Mass. Chief Pilot is Robert C. Sprague, Jr. The company's other pilots are William Benedette, John Gumbleton and Fred Whitham.

Meigs Tower Radio System Engineered, Built by Learcal

NBAA-member Lear, Inc., recently announced the delivery of a complete tower communications system for Meigs Field on Chicago's downtown lakefront. Early in 1953 LearCal was commissioned by the City of Chicago to undertake custom engineering and building of this radio facility.

It is a complete two-way radio communication package, remotely controlled and consisting of four VHF transmitters, four VHF receivers, one medium frequency and two low frequency receivers, housed in two standard, seven-foot steel cabinets.

Frequency range of the transmitters and receivers is 206 kc to 126 mc. The desk-type control console allows speed and ease of operation through the well-engineered arrangement of controls, meters, switches and lights. A standby VHF receiver is provided on the console and provisions have been made to accommodate additional radio channel requirements.



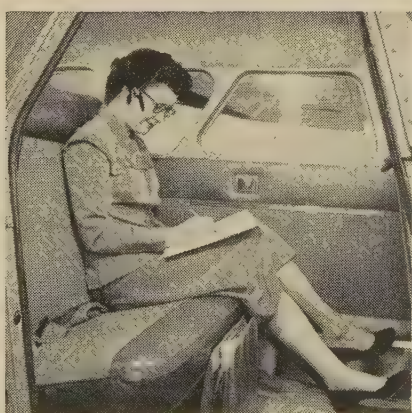
5-Place Utility–Single-Engine Thrift!

New Cessna 195 Offers Greatest Room, Luxury in Single-Engine Field . . . 12 All-New Features!

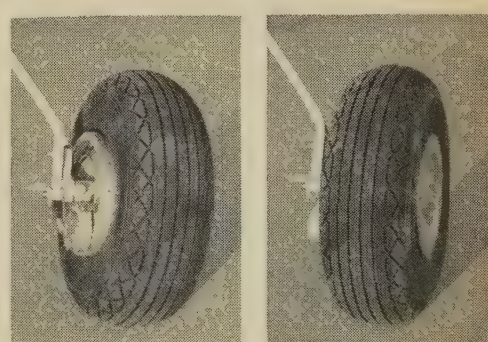
Fly it! Compare it! The one *and only* airplane that offers *both* 5-passenger convenience and single-engine economy—brilliant new Cessna 195! It's powerful! Cruises over 165 m.p.h.! Offers greater comfort than any other single-engine ship! Twelve new features including 50% increase in flap area, larger tail surfaces for easier control, smoother flight, new interior color combinations. For information, see nearest Cessna dealer (listed in yellow pages of phone book) or write CESSNA AIRCRAFT CO., DEPT. S-4, WICHITA, KAN.

Cradled Comfort

Relax in extra-soft foam rubber seats . . . stretch your legs out *full length* . . . enjoy complete comfort! Four fresh-air ventilators; a large thermostatically controlled heating system; entire cabin area is soundproofed. And for a smoother ride, you sit beneath the wing, out of the sun, with a "control tower" view of the scenery below.



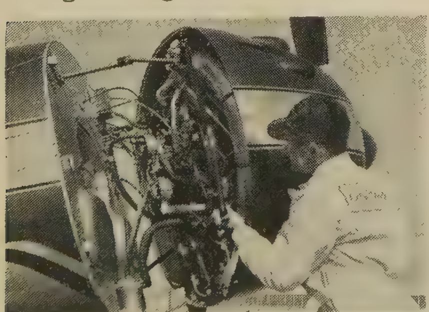
Cessna®
AIRCRAFT COMPANY



Equipped with "Crosswind" Wheels

For safest, smoothest takeoffs and landings . . . standard equipment on the Cessna 195! Eliminates need for lining-up carefully on the runway during landings. Lets you take off easily, safely even when wind is at right angles to the runway!

Hinged Engine Saves Hours



Remove 2 bolts and the Cessna 195 engine swings out for immediate maintenance! You have a choice of two engines: a 300 H.P. Jacobs or a 275 H.P. Jacobs. Both powerful, economical, service-proved, and equipped with Dynafocal shock absorbers for smoother performance.

GREAT CESSNAS 170 180 195 310 THE COMPLETE AIR FLEET FOR EVERY BUSINESS NEED

HIGH SCHOOL GRADUATES:

Train for the Top Career in Aviation

Earn $5,000 a year as an Officer and Pilot in the Air Force

You begin as an Aviation Cadet

To qualify, you must be a high school graduate or college student, single, between 19 and 26½, and able to meet the necessary physical and mental requirements. Once accepted, you receive the finest all around training in the world . . . training that not only fits you for flying, but prepares you for executive and administrative work as well. You will get a monthly allowance of $109.20 while learning, and receive such items as food, clothing, equipment, housing, medical and dental care, and $10,000 worth of insurance . . . absolutely free of charge!

Pre-flight training

Your first stop is Lackland Air Force Base, Texas, where you receive three months of intensive officer training. You'll be plenty busy, especially for the first few weeks, but there'll be some time for recreation, with swimming pools, handball courts, movies and other diversions right on the base.

Primary training

In Primary, you get your first taste of flight. Your flight training is planned in safe, easy stages. You start in a light civilian type "Piper Cub" of approximately 100 horsepower. From there, you go to the 600 horsepower T-6 Texan, your first heavy plane. You'll practice take-offs and landings, basic air work, and instrument flying. On the ground you'll learn navigation, flight planning and other aerial subjects.

Basic training

In Basic, you fly the fast maneuverable T-28, and later, if you are a bomber pilot, the large "Mitchell B-25". If you're slated for jet flying, you'll take your first lessons in a ground jet instrument trainer that simulates the conditions of flight. Then you'll go up with an instructor in the real thing . . . the two seated T-33. Before you know it you'll be flying alone, doing acrobatics and intricate formation flying.

Winning your wings and commission

When you graduate from Basic, you receive your wings and commission as an Air Force 2nd Lieutenant, and start earning over $5,000 a year. As a student officer, you'll then be sent to highly specialized advanced courses.

Advanced training

In advanced training, you fly the fastest, latest planes in the air. These include the F-84-F "Thunder Jet", the F-89 "Scorpion", the F-94 "Starfire", the B-29, and the B-47 "Stratojet". As a skilled pilot, you'll have confidence in yourself, your plane and your future.

Facing the future

After completing the Aviation Cadet Program, you'll be given an indefinite appointment in the Air Force Reserve and called to active duty for a period of three years. From there, your future is set. Your silver wings will open the doors to the best jobs in aviation. You're on your way!

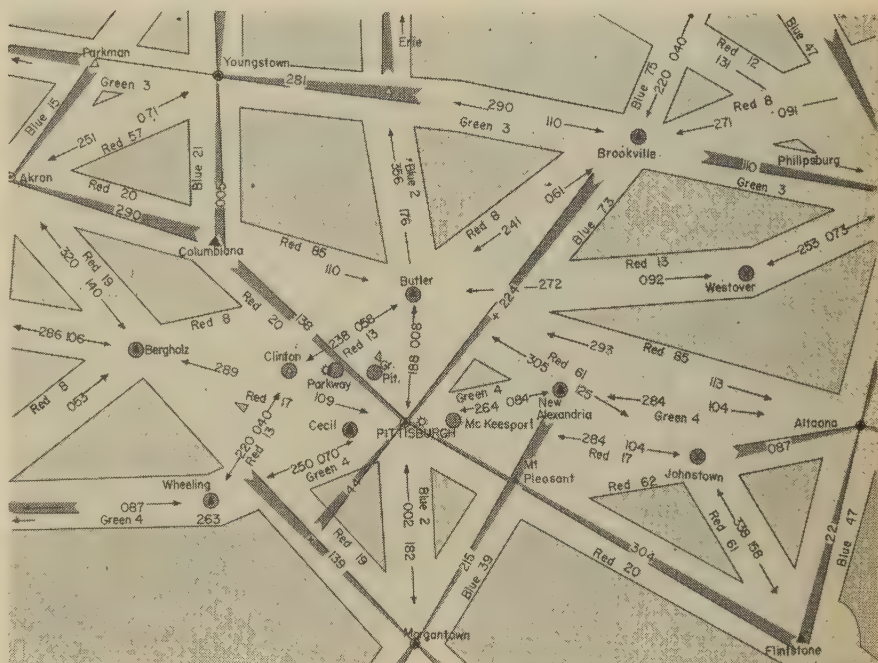
WHERE TO GET MORE DETAILS:

Contact your nearest Air Force Base, Aviation Cadet Selection Team, or Air Force Recruiting Officer . . . Or write to: Aviation Cadet, Headquarters, U. S. Air Force, Washington 25, D.C.

U. S. AIR FORCE

Navigation NAVICOM Communication

Pittsburgh Area Re-Alignment Completed



One of the most complete revisions of Federal Airways radio facilities and routes in a high-density traffic area was completed at the turn of the year. As mentioned earlier last year in NAVICOM, traffic delays in the Pittsburgh area were found to be excessive in terms of the over-all density of traffic both over and in and out of Pittsburgh. Additionally, uncomfortably high altitudes and climbs and descents were imposed.

Considerable research on the part of government experts in the CAA Airways Operations Division with equally valuable assistance from representatives of interested commercial operators, both schedule and non-airline, came up with an answer.

One of the oldest and longest established low-frequency ranges in the country, Pittsburgh, was swung to fit the new proposed alignment of airway routings. ADF radio beacons were relocated, shut down and new ones made operational, and associated low-frequency ranges feeding the area from both ends in the predominantly east-west flow, were similarly realigned.

All this was planned, laid out on paper, and reviewed again and again until all concerned were satisfied that in theory, at least, the plan fitted the need. Flight checks had to be made of the revised facilities and adequate notice given to the flying public via the AIRGUIDE, NOTAMS, company and private manuals.

Then the big gamble! A date had to be picked on which to put through the planned changes with the least possible disruption to the flow of air traffic. Obviously, despite all efforts at pre-notification, to accomplish the changes during a period of bad instrument weather could be disastrous, with pilots and ATC people unable to first check out the new system under more favorable conditions.

Nevertheless, a date was picked and within a day either side of the time of change-over, all changes were completed with only minor incidents and surprisingly little confusion. Although many of the IFR manuals made pre-notification, numerous of the other published charts will not reflect the changes until scheduled revision dates, so the principal changes are published herewith, for comparison with all charts. Note Pittsburgh, Akron and Altoona.

Whether or not the net result will be the expected increased ability to handle traffic will be determined through the balance of the winter with much messy weather promised before spring.

Note also the changed frequencies. Wheeling radio beacon swapped frequencies with Zanesville, Ohio; and Parkway beacon (Middle Comlo on the new ILS landing west) now 302 kc!

Finally the inauguration of Radar Inbound Control at Greater Pittsburgh, serving Allegheny County Airport as well, is expected to insure fullest advantage from these changes.

Radar Inbound Control Eliminates Bottleneck

The inauguration of Radar Inbound Control at Indianapolis, Indiana, adds another link in the over-all plan to expedite the general flow of air traffic over the entire U. S. Bottlenecks caused by delays to arriving traffic in high-density areas inevitably results in adverse effects to enroute over-or-through traffic by forcing long diversionary routings around holding stacks or uncomfortably high altitudes over such stacks, often times not practical for aircraft not equipped for pressurization.

As fast as Airport Surveillance equipment is commissioned at such locations and personnel checked out, Radar Inbound and Departure procedures are worked out and instituted. Such procedures usually follow the pattern indicated at Indianapolis airport.

Arriving aircraft are normally cleared by the controlling Air Route Traffic Center to one of the following fixes, and clearance to change over to Approach Control frequency delivered at the indicated release point.

Clearance Limit or Fix:
- ILS Outer Marker (or COMLO)
- Low Frequency Range
- VOR Range Greenfield Intersection (E course IDL/NW course CIN).
- Nashville Intersection (S course IND/258° track Columbus radio beacon "CLU" 298 kc Atterbury AFB).
- Zionsville Intersection (020° track IND VOR/132° track LAF VOR).

Release Points:
- Greenfield Intersection (see above).
- Nashville Intersection (see above).
- Greencastle Fan Marker (27 miles SW course IND).
- Westfield Intersection (Red 18/Blue 44).

(Continued on Page 28)

Radar Inbound Control Eliminates Bottleneck

(Continued from page 27)

Ten minutes NW of IND LFR.

Aircraft unable to hold at an assigned fix may be assigned other fixes by the Center or Approach Control.

In event of communications failure *prior* to receiving approach clearance, the pilot should operate according to standard radio-failure procedures, proceeding to the approach fix and starting approach at the appropriate time as specified for radio failure. (In this respect, confusion as to type of approach and fix to be used can be eliminated by the pilot indicating at time of receipt of original clearance to the clearance limits noted above whether he can, by virtue of equipment or qualification, make the type of approach being made by other traffic or specify his alternate choice!)

If clearance for approach has been received and communications with Radar or Approach Control cannot be maintained thereafter (a transmission should be heard at least every two minutes), *after leaving the feeder fix* (clearance limits noted above), the pilot should assume radio failure and complete approach *straight-in* if practicable. If not practicable, he should then proceed to the approach fix in use and make approach as soon as practicable.

In this respect, the pilot can be assured that control will be exercised to keep all other traffic the minimum radar separation of three (3) miles from him and usually, as soon as it is apparent that radio failure has occurred, action will be taken as necessary to assure adequate additional separation until approach is completed, alternate action on the pilot's part visually confirmed or communication re-established.

In the event of a missed approach, the pilot may be instructed to climb out the *NW* course of the IND LF range (on Red 14). The alternate to this procedure is the standard missed-approach procedure of climbing out the E course on Green 4 to Greenfield intersection, at 2300 ft.

(Reference: Please refer to page 33, C. & G. Radio Facility Charts, and Airway Manual Enroute and appropriate Instrument Approach Plates.)

Air-Aids Spotlight

ASHVILLE, N. C.: *The BVAR range decommissioned; to be replaced by VOR.*

ISLIP, N. Y.: *The VARW range decommissioned and all dependent airway intersections defined thereby, re-defined in terms of the new RIVERHEAD VORW on 113.9 mc "RVH". Check Airguide. Add two new intersections, BLANCHARD and SHERMAN, on the SE courses of MITCHELL and IDLEWILD respectively, by the intersection of the MacARTHUR (ISP) ILS SW course.*

COLT'S NECK, N.J: CAUTION-*Identify aurally the new VORW (replaces MATAWAN VAR) on 113.1 mc with manually tunable VHF receivers! Identification "OLT" uncomfortably close to WILTON, Conn.'s "ILT" on 113.6 mc.*

COYLE, N. J: *The missing link in the North-South by-pass airway to the East of the New York Metropolitan Area via ATLANTIC CITY and RIVERHEAD, L.I., will be provided if current tests of a new VOR in this location are successful. The West by-pass airway still held up by site difficulties for the replacement for CALDWELL, N. J. VOR.*

GREENSBORO, N. C: *Parallel East-West one-way airways between Amber 7 and Green 6 in this area accomplished by swinging the NW course of RALEIGH to 128°, Red Airway 34 coinciding with this course to the NW course of GREENSBORO; then swinging the SE course of GREENSBORO to 308°, creating a new airway, Red 104. At the same time, WINSTON-SALEM SW and NE courses swung to 058°-258° respectively. Check Airguide for new intersection announcements.*

OKLAHOMA CITY, Okla: *VORW recommissioned at new location. Final approach course no longer aligned with Runway 12! New heading to airport in vicinity of 95-100°*

TULSA, Okla: *Although civil non-air carrier ILS minimums prohibit descent on glide slope as far as the Middle Marker, new slope and altitude over the MM (900') is closer to current minimums; but* descent on the Glide Path beyond the MM is hazardous, unless runway is in sight!

WHEELING, W. Va., ZANESVILLE, O: *These two facilities, both radio beacons, swapped frequencies! WHEELING "HLG" now 263 kc and ZANESVILLE now 275 kc.*

Preferential Routings for N. Y. and Phila. Area

Numerous requests have been received for a compilation of the various specialized area routings that have been publicized in earlier issues of Navicom, in a form that the pilot could make use of in his daily flight planning. In the course of frequent flights through, or to and from, these areas, pilots will find that a voluntary filing of these routes will not only expedite their own flight but generally speed up the movement of all traffic.

Therefore, the pilot practice of referring to the following guide before filing will benefit all phases of IFR flying, although individual requests for deviations because of known meteorological hazards, *i.e.* heavy icing and thunderstorms, will be given all possible consideration.

The compilation here is credited to the staff of the N. Y. Air Route Traffic Control Center and is offered in a bulletin disseminated for public use. It is hoped that we will be able to bring to our readers in similar handy reference form, the same information about routings in other high-density areas. Efforts are presently being made to obtain these routings.

Notice that in many cases purely Victor Airways routings are often not available, usually due to current lack of commissioned VOR facilities along the preferred route of traffic flow. This lack is expected to be made up shortly by programmed facilities.

TO: ....LAGUARDIA

FROM	LF AIRWAY	VHF AIRWAY
Albany, NY	*Blue 18—West Point-HPN OM—New Rochelle*	*V91—direct New Rochelle*
Binghamton	*Red 26—Green 3*	*V34—Newburgh—HPN OM—New Rochelle*
Boston	*Amber 7—New Rochelle*	*V3—ILT—direct New Rochelle*
Buffalo	*Red 23—Red 26—Green 3*	*V36—V72 V34—Newburgh—HPN OM—New Rochelle*
Cleveland	*Green 3*	*V6—V10—Flatbush*

Columbus	Green 4—Red 13—Green 3	V12—V58—V6—V10—Flatbush
Detroit	Red 12—Green 3	V10—Flatbush
Harrisburg	Green 4—Red 33—Green 3; or Green 4-Red 3—Green 3	V12—V39—V10—Flatbush
Phila., Pa.	Red 3—Green 3	Unavailable
Pittsburgh	Red 13—Green 3	V58—V10—Flatbush
Washington	Red 45—Amber 7—Red 3	Unavailable

TO .... NEWARK

FROM:	LF AIRWAY	VHF AIRWAY
Albany	*BL 18—PAT—direct EWR OM*	*V91 POU—BL 18 PAT—direct EWR ILS OM*
Atlantic City (& South)	*Amber 9 Matawan—direct EWR OM*	Unavailable
Binghamton	*Red 26—Green 3—Amber 7*	*V34—BL 18—PAT—direct EWR OM*
Boston	*Amber 7—HFD—Red 13—POU—BL 18—PAT—direct EWR OM*	*V3 HFD—V58—POU—BL 18—PAT—direct EWR OM*
Cleveland (& West)	*Green 3—Amber 7*	*V6—V10—EWR OM*
Elmira, NY (& North)	*Red 23—Red 26—Green 3—Amber 7*	*V36—V29—V10—New Brunswick—direct EWR LOM*
Detroit	*Red 12—Green 3—Amber 7*	*V10—New Brunswick—direct EWR LOM*
Harrisburg	*Green 4—Red 33—Green 3—Amber 7*	*V12—V39—V10—New Brunswick—direct EWR LOM*
Phila. Pa.	*Amber 7*	Unavailable
Pittsburgh	*Red 13—Green 3—Amber 7*	*V58—V10—New Brunswick—direct EWR LOM*
Washington	*Amber—7*	Unavailable

FROM .... NEWARK

TO:	LF AIRWAY	VHF AIRWAY
Albany	*Direct PAT—BL 18*	*Direct PAT—BL—18—POU—V91*
Atlantic Cy (& South)	*Direct MWA—Amber 9*	*(Unavailable)*
Binghamton (& North)	*Red 8—Red 26*	*Direct Stroudsburg—direct AVP VOR—V29*
Boston	*Direct PAT—BL—18 Red 13—Green 5—Green 2*	*(Unavailable)*
Cleveland (& West)	*Red 8—Green 3*	*Direct PAT—direct Branchville—V36—V58 IPT—Red 8—V6*
Elmira (& North)	*Red 8—Red 26—Red 23*	*Direct Stroudsburg*
Harrisburg	*Red 8—Red 33—Green 4*	*Direct Chatham—direct Stroudsburg—V39—V12*
Phila.	*Direct Chatham—Red 72—BL 20*	*Direct Chatham—V3—Wings—BL 20*
Pittsburgh	*Red 8—BL 2*	*(Unavailable)*
Washington	*Direct Chatham—Red 72—Red 45—Red 33—Red 29 Ellicott City—Direct RIV—Amber 7*	*Direct Chatham—V3—Willow Grove—Red 45 Lanc V93—Amber 7*

FROM .... LAGUARDIA

TO:	LF AIRWAY	VHF AIRWAY
Allentown	*Red 23—Red 33*	*Direct Branchville—V39*
Albany	*Direct Paterson—BL 18*	*Direct PAT—BL—18—POU—V91*
Baltimore	*Chatham—Red 72—Red 45—Red 29—Red 17*	*(Unavailable)*
Bridgeport	*Red 23—Red 21*	*(Unavailable)*
Binghamton	*Red 23—Red 26*	*Direct Branchville—V36—V29*
Boston	*Red 23—Green 5—Green 2*	*(Unavailable)*
Buffalo	*Red 23*	*Direct Branchville—V36*
Cleveland	*Red 23—Red 51—BL 11*	*Direct Brvl.—V36—V116—V14*
Columbus	*Red 23—Red 13—Red 8—Green 4*	*Direct Brvl. V36—V58 IPT—Red 8—V12*

(Continued on page 30)

Preferential Routings for N.Y. and Phila. Area

(Continued from page 29)

Chicago	*Red 23—Red 51—Red 12—Green 2—Red 12*	*Direct Branchville V36—V116—V10*
Detroit	*Red 23—Red 51—Red 12—Green 2*	*Direct Branchville—V36—V116—V10*
Phila. Pa.	*Chatham—Red 72—BL 20*	*(Unavailable)*
Pittsburgh	*Red 23—Red 13—Red 21—Red 8—BL 2*	*Direct Branchville—V36—V58 IPT—Red 8—BL 2*
Washington	*Direct Chatham—Red 72—Red 45—Red 33—Red 29 Ellicott City—Direct RIV—Amber 7*	*Direct Chatham—V3—Willow Grove—Red 45—Lanc—V93—Amber 7*

TO . . . . IDLEWILD

FROM:	LF AIRWAY	VHF AIRWAY
Albany	*BL 18—West Point—direct HPN LOM—direct Glen Cove*	*V91—direct Glen Cove*
Boston	*Green 5—Mitchel—direct IDL*	*Unavailable*
Binghamton (& North)	*Red 26—Green 3—Red Bank—direct Scotland*	*V34—Glen Cove*
Cleveland (& West)	*Green 3—Red Bank—direct Scotland*	*V6—V10—direct Red Bank—direct Scotland*
Phila. Pa.	*Red 3—Red Bank—direct Scotland or BL 20—Green 5*	*Unavailable*
Pittsburgh	*Red 13—Green 3—Matawan—direct Red Bank—direct Scotland*	*Red 13—V10—direct Red Bank—direct Scotland*
Washington	*Green 5*	*Unavailable*

TO . . . . PHILADELPHIA INTERNATIONAL

FROM:	LF AIRWAY	VHF AIRWAY
Allentown (& North)	*BL 20*	*V29—direct PHL*
Cleveland (& West)	*Green 3—Red 3—Green 4*	*V6—V33—V12—direct PHL*
Detroit	*Red 12—Red 3—Green 4*	*V10—V33—V12—direct PHL*
Harrisburg (& West)	*Green 4*	*V12—direct PHL*
Norfolk (& South)	*Green 6—Bl 56—Red 77—Bl 20*	*Unavailable*
Washington	*Amber 7 or Green 5—Bl 20*	*Direct BAL—V3—direct PHL*

FROM . . . . PHILADELPHIA INTERNATIONAL

TO:	LF AIRWAY	VHF AIRWAY
Allentown (& North)	*BL 20*	*Direct ABL VOR*
Cleveland (& West)	*Direct Wings—Direct Lanc—Green 4—Red 3—Green 3*	*Direct Wings—Direct Lanc—V12—V33—V6*
Harrisburg (& West)	*Direct Wings—Direct Lanc—Green 4*	*Direct Wings—Direct Lanc—V12*
Norfolk (& South)	*BL 20—Red 77—BL 56—Green 6*	*(Unavailable)*
Washington	*Direct Wings—Direct Lanc—Red 45—Red 33—Ellicott City—RIV—Amber 7*	*(Unavailable)*

FROM . . . . IDLEWILD

TO:	LF AIRWAY	VHF AIRWAY
Albany	*Direct Glen Cove—Direct HPN LOM—POU—BL 18*	*Direct Glen Cove—ILT VOR—V91*
Boston (& Northeast)	*Green 5—Green 2 (& Amber 7 to Northeast)*	*(Unavailable)*
Binghamton (& North)	*Direct Glen Cove—Direct New Rochelle—Direct PAT—Red 23—Red 26*	*Direct Glen Cove—Direct ILT VOR—V34*
Detroit (& West)	*Direct Glen Cove—Direct New Rochelle—Direct PAT—Red 23—Red 51—Red 12*	*Direct Glen Cove—Direct New Rochelle—Direct PAT—Direct Branchville—V36—V116—V10*
Phila.	*Green 5—BL 20*	*(Unavailable)*
Washington	*Green 5—Andrews—Direct DCA*	*(Unavailable)*

Pilots: NAVICOM is designed to aid you. Please let us know of any specific navigation/communication service, not now offered in NAVICOM, that you would like us to feature.—Ed.

Skyways Round Table

(Continued from page 19)

Capt. John Gill: "As I understand it, we're very close to having available a unit on the aircraft that will give identification. If we could implement the radar program, New York—Washington, then New York—Boston and then spread out from that high-density area, our problems would be taken care of a lot easier than we now think. Take the air search radar (ASR-5) which covers 115 miles, with this type of gear any target that impinged on the area could be identified by the area controller and passed over to individual segment controllers of the area, and then carried by means of marked pips on the scope."

Max Karant: "Capt. Gill, did I understand you to say that the New York to Washington airway could be implemented with enroute radar right now?"

Capt. Gill: "I'd say yes."

Huck Smith: "The Airways Operation Division, Region One, is now in the process of developing procedures for radar control between Washington, Baltimore, Philadelphia and Newark. With those radar systems, we have overlapping coverage between those major terminals. Sometime ago, a test was conducted on the Newark radar with the scope off-centered, and the controllers were able to track aircraft coming out of Philly from 62 miles at an altitude of 3,000 feet.

"We now feel that it would be possible to implement a low-altitude radar control between those points, providing sufficient radar equipment is made available. While we do not anticipate utilizing the minimum of a 3-mile separation between successive aircraft arriving from Philly, the separation can remain constant and do much to eliminate 'breaks' in the arrival sequence.

"In implementing this program, there will have to be some sort of speed control, plus or minus a pre-determined setting, in order to maintain any semblance of order between successive aircraft. While today we're only getting one or two aircraft in a block of airspace 60 miles long, with our radar system we may be able to double that in the same amount of airspace. I'm now speaking of IFR. Actually, as far as the controller is concerned, this will be strictly a monitoring job. We do not visualize actually vectoring aircraft between those points. The pilot will do his own navigating and we will afford the separation between successive departures going to and from those terminal areas. The separation will probably be on the order of 15 or 20 miles between successive arrivals out of Philly, since traffic coming in from other directions will have to be funneled in between the Philly traffic. Therefore, while we may provide 20-mile separation between aircraft coming out of Philly, the result at the end of the runway at Newark between successive arrivals should be approximately 3 miles."

Capt. Gill: "Huck is a recognized authority on that subject and knows whereof he speaks. He mentioned the need for additional equipment. I think we also need additional manpower. With the present economy program, there's going to have to be a reversal of present trends in CAA thinking, or the budget bureau's thinking

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Skyways Round Table

(Continued from page 31)

of CAA's requirements, if we are to accomplish a safe job in air traffic control. I personally feel that the Government already has gone too far in cutting in a place that really should be expanded."

William Person: *"Let's hear from a business pilot."*

B. J. Malloy *(Asst. Chief Pilot, Swiflite Aircraft Corp.)*: "I'd like to offer a fervent 'Amen' to the things Capt. Van Liew brought up, particularly with regard to this matter of the integrity of pilots in reporting over fixes. I guess we've all witnessed this competition as we approach high-density areas.

"Recently, I had an opportunity to spend an hour and a half with the radar people at Washington National, and I'd certainly recommend the visit to anyone who can afford the time. It was extremely worthwhile.

"As Capt. Van Liew also mentioned, speed is a major item of consideration. My company flies everything from a DC-3 to an A-26, and that covers a wide range of speeds up to and including the airline DC-6's and *Constellations.* We've run into quite a problem with variations in speeds, particularly in the New York area. When we come into LaGuardia with a DC-3, we have to buck the DC-6's, and from our experience with the A-26, I realize it's hard to pull everything back on the throttle quadrant to slow down. But pinning us down to a set speed of 150 or 160 within these high-density areas certainly would improve things all around . . . and not just in IFR. You expect that sort of thing in the holding pattern in IFR, but in VFR weather there is a lot of competition as to who's going to get into the pattern and who's going to get on the ground. Frankly, I can't see where a pilot will save more than about 30 seconds in this vying for positions with the tower."

Huck Smith: "In this matter of speed, we had an incident at Washington recently in which a DC-3 actually caught up with a DC-4 after they were established on final approach. When the two aircraft were turned onto the localizer course for their ILS approach, a good 4-mile separation had been established. Apparently, the DC-3 pilot was pushing the throttles more than he normally would and, as a result, caught up with the DC-4 which resulted in a less than standard radar separation. Therefore, you can see that there is a necessity for controlled airspeeds, particularly within the immediate vicinity of the terminal.

"As far as reporting is concerned, there are undoubtedly a lot of pilots who do not realize the necessity of making an accurate report. The communications lag probably promotes this inaccurate reporting. A pilot can't get on the microphone at the particular time he is over the fix and by the time he does get through, he may be a mile or two past the fix. This presents a problem insofar as the radar program is concerned. We are relying a great deal upon coincidence reporting as a means of identification. We have found, however, that coincidence reporting alone does not suffice; in addition we've had to ask for an identifying turn so that we can positively identify the aircraft. Flying into Washington, for example, a pilot reporting over Springfield invariably will get a 160° or 170° heading away from the fix to insure positive identification."

William Person: *"Capt. J. D. Smith, we'd like to hear your comments, too."*

Capt. J. D. Smith *(Regional Safety Chairman, ALPA)*: "Referring back to the title of this discussion, of whether or not present regulations are adequate, I'd say the answer is no.

"Enroute, the 500-on-top operation is a joke. You aren't getting any separation. We recently eliminated it in the holding patterns in the New York area. If you're heading eastbound and you're flying '5 on top' on an early morning flight, you are actually on instruments because you can't see anything, and you aren't getting any separation whatsoever. Then they throw the monkey on your back because the regulation states that it's your responsibility, regardless of your conversion course with other aircraft, to provide separation from traffic.

"From the terminal part of the problem, I think we all realize we need better procedures to more efficiently handle the traffic. Present terminal procedures for IFR operations are not inadequate, safety-wise, but they are inadequate from an efficiency standpoint. Perhaps the main reason we haven't come up with something that can be called a better operation, efficiency-wise, at New York is due to the fact that we have three major airports located in a small area. When you start crossing your outbounds and your inbounds, you have a problem.

"Radar as an aid could help us solve some of our problems. However, consistent 24-hour radar reliability does not yet exist.

"Speed control in high-density areas is an interesting subject. One point not yet answered is whether or not the problem isn't being moved further away from the airport where there is less control.

"One thing we haven't gotten into in this discussion is the IFR and VFR traffic converging on a high-density airport, and that brings us down to the present VFR minimums and whether they are adequate or not. I'm of the opinion that they are not."

William Person: *"Tom Davis, I believe you have a comment to make."*

T. A. Davis *(Chief, General Safety Branch, Reg. 1, CAA)*: "You should add one more item to speed and density, and that's the type of airplane and pilot. Single-engine aircraft are increasing in reliability, and businessmen are realizing this. Consequently, the larger populated areas already are beginning to feel the increase in small business aircraft. These aircraft more often than not are flown by non-professional pilots. As traffic-control procedures improve, I think you are going to find a third element in your traffic control that will have to be reckoned with, and that is the businessman-pilot flying during marginal VFR conditions and entering a congested area where there is considerable IFR traffic. These aircraft must fit themselves into a traffic procedure which is quite complicated and results in considerable delay and confusion. The small airplane is going to keep on increasing in utility and in numbers."

Capt. J. D. Smith: "You mention that single-engine airplanes are becoming more reliable. I imagine you mean performance-wise and equipment-wise. Offhand, would you say that the reliability has increased to the point where a CAA regulation permitting take-off in zero-zero weather would make sense?"

T. A. Davis: "On a small single-engine airplane, I don't think so."

Capt. J. D. Smith: "Well, let's put it this way. If I took off in a single-engine airplane, one that met all the requirements, performance-wise and equipment-wise, in zero-zero weather, what course of action would the CAA take against me for doing that?"

T. A. Davis: "We have not tied down the take-off minimums for other than scheduled air carriers."

Max Karant: "No, there's no law that prevents you from going out and committing suicide if you want to. As a matter of fact, the chances are that nobody checks on you at any time to see if you are qualified before you take off. The philosophy of our government and its regulation of people who use the ground—the surface transportation—and the airways, is that you are not guilty of anything until you prove you are. From time to time, a number of pilots try to take off in zero-zero weather and almost invariably they kill themselves. It frankly amazes me . . . I don't understand it, but there it is. It has been proposed many times that perhaps a solution to this would be to just pass a law saying you can't do it; a law that would enable somebody to stop a man from getting into his airplane and taking off."

Capt. Van Liew: "Relative to what Max just said and relative to your remark on the adequacy of rules and regulations, it is awfully hard to write good judgment into the regulations. When you come right down to it, if you carefully analyzed every rule and regulation regarding aviation, you'd find they cover almost every contingency. But every rule and regulation is subjected to the pilot's perogative in a particular situation, and I don't think you can put good judgement into any regulation. That's up to the individual."

Capt. J. D. Smith: "I agree with you 100%. As far as rules and regulations go, I exist four days out of 30 each month in which I'm not covered by some CAA rule or regulation. But the point is, are the procedures and regs adequate for the enforcement of a continuous safe operation in or out of an airport or along an airway? I still say they are not.

"Take-offs are being made where weather is below airline minimums and there is no action taken. Yet the airline pilot, who theoretically should have the best chance, equipment-wise, for a successful take-off under low weather conditions, is compelled to go back to the gate, even though he can see the length of the runway."

Max Karant: "Have you ever suggested additions to the regulations that you think might prevent a pilot from taking off?"

Capt. J. D. Smith: "From the standpoint of an airline-type operation, your suggestion is not necessary. We do have regulations prohibiting take-offs and landings below certain weather conditions. Disci-

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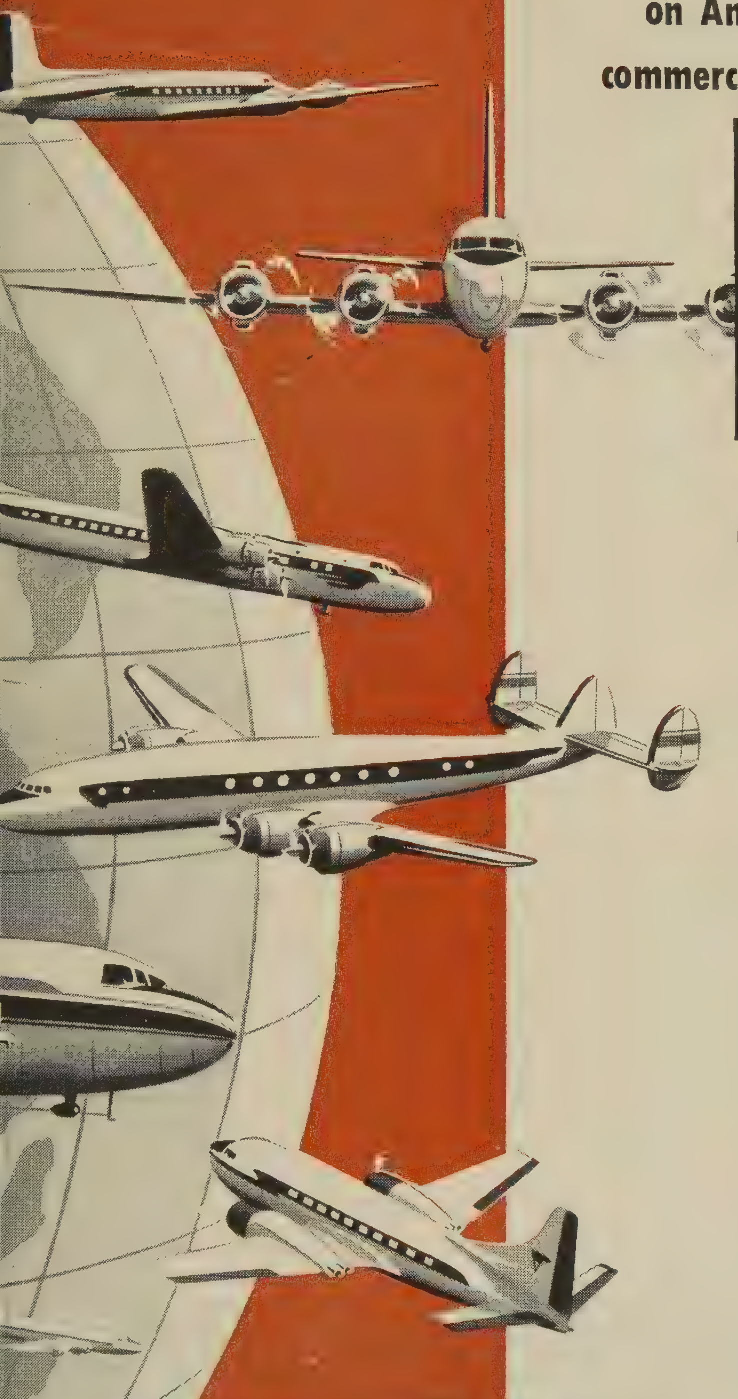

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Skyways Round Table

(Continued from page 32)

plinary action that would be taken against an airline pilot, should these regulations be willfully violated, is sufficient cause to make these rules very effective."

Capt. Van Liew: "You've been talking about take-off, but I'd like to digress a minute and get to my pet fetish in this rules and regulations business. Here's an example that occurred only a couple of days ago.

"Approaching Chicago, there were four of us holding in the approach control stack at the Outer Marker. I was at 3500 feet and there was another plane under me at 2500 feet. There was a unique weather situation in which winds were variable and up to 60 and 70 mph, and the holding pattern down as low as 2500 feet. The plane at 2500 feet was told to leave the OM at 51. We held at 3500 feet, and then at 56 we heard Approach Control come on and ask, 'Airline X, have you reached the Outer Marker?' The pilot replied that he had not, but that he would let Approach Control know when he was leaving the OM. In the meantime I had been told to leave the Outer Marker at 57, thus providing a 3-minute separation. I dipsy-doodled around and at 59 the other plane reported he was leaving the OM and I left the Outer Marker on the hour. There was a guy in a Twin Beech holding at 5500 feet and he wasn't enjoying this one little iota, and there was somebody in back of him enroute. Because of this one guy's complete lack of precision and not leaving a particular point when he was told to, somebody enroute was held up seven minutes, and somebody someplace else was held up seven minutes. This whole thing snowballs all the way back to a point where it costs the airlines money and could cost lives."

Capt. J. D. Smith: "I agree with you as far as the over-all operation is concerned. However, studies have shown that such a situation as was just mentioned is many times not the result of cockpit management but rather is due to existing procedures. Let me ask you this . . . I seem to get the impression that you are of the opinion that all the rules and regulations governing traffic control are adequate, and all you have to do to solve the problems is to straighten out the pilots."

Capt. Van Liew: "No, I don't say that. I think the regulations are adequate as far as they go. You have to have a platform to operate from and at the present time you can't just toss out all the rules and regulations and start off new, because each rule or regulation has a reason for being there. However, I do think they should be modified."

Capt. J. D. Smith: "If we'll be honest with ourselves, I think we'll agree that the basic theory of 3 miles visibility to VFR minimum is inadequate when you consider the type of equipment that is operating in and out of high-density areas."

Capt. Kim Scribner *(Chief Pilot, Atlantic Div., Pan American Airways):* "One thought I have concerns the airline industry and the private pilots as well as business pilots, and that is the ever-existing potential mid-air collision problem. I wonder if the regulations are considered adequate to handle such a problem. I feel that along with airline and commercial flying growing pains, there are growing pains to be realized with respect to civil air regulations. We know that the CAB is rewriting Part 40 of the CAR's and is contemplating the rewrite of Part 41, and I think you'll find a rewrite of Part 60 coming up. In conjunction with that, we are probably going to have committees established for the primary purpose of finding out how we can relieve ourselves and the industry of potential mid-air collisions. Perhaps we should regulate small-aircraft flying to a degree where it will not put them in the line of sight of the larger aircraft. This opinion is not based entirely on airline operation, because I once was an airport operator and handled flying schools and flew lightplanes. That suggestion is based on a mixture of lightplane operation and airline work."

William Person: *"Frankly, I feel we should carry that suggestion a step further and apply it to airline aircraft as well as private planes. A short time ago we had an incident that involved two airline aircraft in a potential mid-air collision."*

Capt. Scribner: "This has been discussed among airline pilots who have had previous experience with small planes, as most all of us have, and we feel that we will not have real air traffic control until we have control over VFR operations on airways. We don't see how we can rely on the wide scope of visual reference to everything, leaving it entirely up to the judgment of the pilots themselves to control it. If there were wisdom in that approach to the problem, we wouldn't have road traffic laws today. We have to put the responsibility into regulations and demand certain things of all pilots."

Herbert O. Fisher *(Chief, Aviation Development Div., Port of New York Authority):* "The Port Authority is interested in obtaining the maximum air traffic and the maximum utilization of every airport that we operate. If the traffic regulations are such that it prevents us from attaining maximum utilization of our facilities, then we are interested in it and we of the Port Authority want to do whatever we can to assist in this airway problem.

"Going back to utilization of airports, you men have covered radar. Obviously, we are in favor of that because it means more traffic can be handled. But there are other conditions, too, that interest us.

"We are concerned with missed approaches, primarily from a safety and a noise standpoint. We are interested in this business of zero-zero take-offs as against the present air carrier take-off maximums. There has to be some clarification as to whether a zero-zero take-off as against the airlines taking off with a minimum is consistent in this day of operation. In the light of the general public it's pretty hard to justify a private airplane's taking off when the airlines aren't operating. I'm not saying which is right, but I am saying that this operation is inconsistent.

"Another item of interest is this business of circling approaches. Under IFR conditions, we have a lot of low circling, below 600 feet, and I can assure you that it causes us a lot of trouble. Perhaps radar and bi-directional approach will settle that.

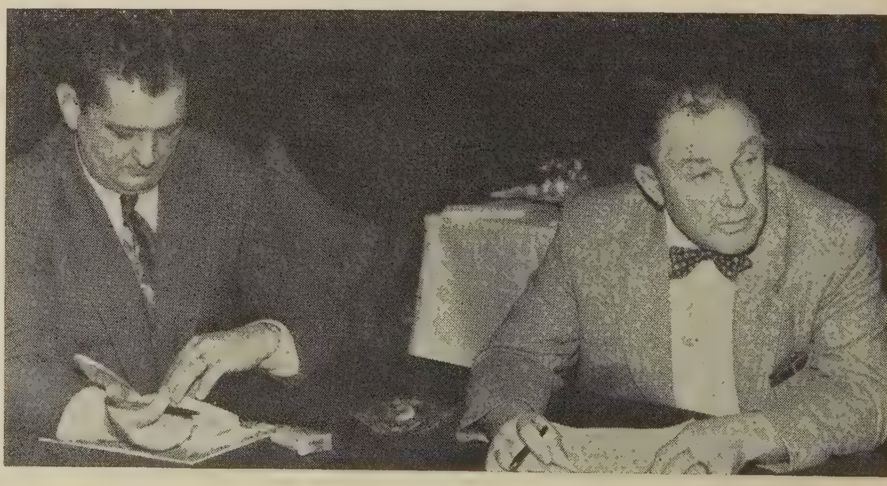
"Next on the list is the instrument pilot who is not as proficient as he should be. There are a lot of pilots coming into this area when it is IFR who either have an instrument rating but aren't as proficient as they should be or who haven't any instrument rating at all. We cannot tolerate any fringe operation here. We cannot tolerate anybody flying into this area who is a potential accident because of either carelessness, neglect or lack of training.

"Inadequacy of equipment is another problem. Does a pilot have at least two-way radio when he comes in here under marginal conditions? Is he maintaining his airplane properly? Most of the corporations that operate aircraft make certain those planes get the finest maintenance, but there are plenty that do not.

"As I said earlier, the Port Authority is interested in these things because they have to do with the safety of all operations within this high-density area."

William Person: *"Herb, you are probably the best qualified man here to dwell for a minute on this business of aviation's responsibility to the neighboring areas around the airports. The question came up as to whether a man taking off in zero-zero weather didn't have more than his own life at stake. Do you want to go into that a little more deeply?"*

"IF WE COULD *implement the radar program . . . our problems would be taken care of a lot easier than we now think," said John Gill (right), shown with Huck Smith*



erbert O. Fisher: "The point I tried
make is, how do we justify a pilot tak-
g off in zero-zero weather and cracking
p at the end of the runway? We've had
everal cases where not a single airliner
as taking off, yet we had flights taking
f from all three of our airports in what
ould be the equivalent of zero-zero.

"Remember, I'm not questioning whether
not the airlines should drop their mini-
ums or the other operators go up to
me minimum. It's just that it's a ques-
on that comes up in the community rela-
ons between airports and their neighbors.
hy should one be permitted to take off
nder zero-zero conditions when the other
e isn't?"

ohn J. Quinn *(Chief, General Rules
iv., Bureau of Safety Regulations, CAB):*
There are a few areas of this discussion
at I would like to cover from a stand-
oint of Civil Air Regulations since these
gulations are primarily the product of
e CAB's Bureau of Regulations.

"The CAB staff is very much concerned
bout the continuing adequacy of our air
affic rules as set out in the present Part
. For the past two years we have been
ying to evaluate different concepts, par-
cularly as to what should be set up as
andards for VFR flying. Most of the
nversation today has dealt with air traf-
control practices and procedures. Under
esent air traffic rules, positive air traffic
ntrol comes into full play only during
R operations which constitute only a
all part of the total time an aircraft is
wn. Some figures show that 90% of flights
e under VFR weather conditions. The
FR operations are conducted principally
the judgment and decision of the pilot.
we are to have more positive control of
rcraft under the present system, we first
ust determine the demarcation between
FR and IFR flight operations. This line
demarcation is a signal which causes
e pilot to revert to full air traffic control
erations, since after he files his flight
an and conducts his flight in accordance
th the terms of that flight clearance, he
cures separation from other aircraft. In
rms of more positive control of aircraft,
think we have to deal with the control
at can be exercised by use of facilities
at are available at this time rather than
ose which we hope to have in three or
ur years, such as full radar control of air
affic by the use of ground and airborne
uipment.

"In obtaining fair play for everybody it
also necessary to provide adequate safe-
for all. Eventually, the problems we've
scussed are going to be licked. For in-
ance, in the use of radar one of the
gaboos has been the development of a
vice that would immediately tell a traf-
controller which aircraft he was talking
instead of forcing him to spend four
five minutes identifying one plane when
has a bunch of them out there to con-
nd with. Such problems as this will be
lved, but I think we first have to put in
oper order our primary use of the air-
ace and be fair to the users of it. In
her words, we must establish adequate
d fair VFR rules.

illiam Person: *"Let's go back to this
ibility problem, gentlemen. It's the prob-
n that involves the pilot who sees a
rginal condition and so he files an instrument flight plan and gets separation from other aircraft also on instrument flight plans, but does not get separation from aircraft flying VFR in a marginal condition."*

Max Karant: "This is a very serious problem, and one that brings up the question of equipment. How is a guy going to carry 150 pounds of radio equipment in a plane that can only carry two people to begin with? Also, that equipment is usually very expensive."

T. A. Davis: "This immediately gets into the problem of enforcement and is very difficult. Pilots object to becoming a part of the law enforcement procedure. Since we cannot police all the airways all the time, we must depend upon industry compliance. Where irregularities are noted, unless they are reported in sufficient detail to effect remedies, improvement will be difficult. Even though you have a control area, it still doesn't keep a pilot from taking off, flying into a high-density area in VFR weather and then suddenly having a fog roll in under him. You'll find its difficult to regulate safety, and you still have to put a lot of responsibility on the pilot."

John J. Quinn: "Has it been decided that 5 miles or less is marginal or that 3 miles or less is marginal? In other words, when you talk about marginal, where are we?"

William Person: *"That's a good question, Mr. Quinn. I think it depends entirely on what kind of equipment you're flying; what function you are trying to perform."*

John J. Quinn: "To put it brutally frank, is this a system of rationing air traffic, a priority of air traffic, or is it really and necessarily a safety deal? Here's why I ask that question. At Minneapolis they conducted a test by flying two airplanes to a position three miles from the tower. Now visibility was more than 5 miles, but the test showed that unless you knew which quadrant the airplane was in, you almost never picked the airplane up at all. Are we going to 5 miles visibility for VFR flight, and if so, from how far off can you actually tell what course a plane is taking, whether he's intercepting or overtaking? Where do you begin to get definite knowledge of the importance of your collision factors, etc?"

William Person: *"I think it goes a lot farther than just 5 miles. It depends entirely on how much time the men in the cockpit have to devote to looking. The crew can have a rough engine, paper work, radio contacts, check lists,—all these things enter into the problem we call visibility. Maybe it should be 15 miles instead of 5 miles. I don't think we really know."*

John J. Quinn: "Perhaps there ought to be different procedures in the cockpit so that pilots aren't required to perform certain duties at a time when the traffic is getting thick and they should be looking at what they're getting into rather than being involved with other procedures. I've examined several collision accidents in the vicinity of airports and it has seemed to me that the pilot and often the copilot were doing something other than paying attention to what was going on outside."

William Person: *"What with talking to centers, approach control, the tower, and*

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Skyways Round Table

(Continued from page 35)

half the time selecting frequencies faster than they are identified, the two men in the cockpit are more than busy under marginal weather conditions. It's quite a work load in the cockpit."

Max Karant: "Are you advocating that they don't look?"

William Person: *"Not at all, but I am trying to be realistic about a very serious problem."*

Max Karant: "Then how can you pass a law that would govern all civil aircraft that would be based on the fact that the pilots in some airplanes are too busy to look around?"

Herbert O. Fisher: "I've flown in this area for about seven years in both high-speed aircraft and so-called lightplanes. And so far as this visibility question is concerned, I realize that the higher the speed the harder it is to see anyone. Also, there are times in this area when VFR is quoted when actually it is way below VFR. Perhaps if VFR were 5 miles and 1500 feet or whatever figure was decided upon, it would make all operations a lot safer and give pilots a better chance of seeing each other.

"Frankly, when you are operating at fairly high speed against planes of lesser speed in this area and in this fringe VFR-IFR condition, there are bound to be near-misses. It's a wonder we haven't had a mid-air collision! I think we're kidding ourselves when we say 3 miles and 1,000 feet, under certain conditions in an area like New York, is adequate. It isn't!"

Capt. J. D. Smith: "I'd like to cover one point that has to do with determining what visibility should be used as a VFR minimum, and that is airplane conspicuity. What can the human eye see? How far can it see? Does the pilot have time to maneuver his airplane? What is the time element involved?

"Where you have a pilot in a holding pattern during IFR conditions there is a possibility that either the pilot or copilot are not looking out as much as they should because of their cockpit functions. However, whenever VFR or IFR enroute, speaking for myself, my head is going in all directions.

"If the records are accurate, in seven years there were 140 mid-air collisions involving non air-carrier aircraft. The interesting thing to note is that there were none under IFR conditions; there were 139 in daytime conditions and only one at night. The minimum visibility, according to figures, was never less than 5 miles. I mention this because here we've had 140 mid-air collisions between aircraft of similar speeds when visibility was greater than 5 miles, and yet we are constantly being asked to operate without any controlled separation, with aircraft having greater speed differences in a higher density area, with only 3 miles visibility. That's the inconsistency of the regulations."

Capt. L. M. Holloway *(Sector Chief Pilot, Pan American Airways)*: "A few minutes ago, Mr. Fisher mentioned pilots coming in here who are not qualified, and it brought to mind an experience I recently had. We were holding at LaGuardia and the controller cleared an itinerant aircraft to the Holmes holding pattern. The pilot of that aircraft called back, 'What is that?' That whole operation kept me waiting some 45 minutes until the fellow was on the ground.

"Radar probably will play a most important part in both area and enroute traffic control, and a means of aircraft identification is part of it.

"When we talk of regulations and the fact that an itinerant pilot, that is, a private pilot, can take off under zero-zero conditions while the airlines are not permitted to do so, the question of judgment enters into it. What I want to know is why does a regulation assume that a private pilot with 50 or 100 hours has greater experience than an airline pilot? That just doesn't make sense to me, but the situation exists."

Max Karant: "The CAB regulations do not assume that a man has more experience. The CAB simply does not take unto itself the right to keep a man from committing suicide. The regulations that apply to the air carriers are slightly different in view of the fact that they are public carriers carrying the general public. Therefore, the CAB has a whole set of regulations that apply to air carriers—and they don't apply to us. We can go charging right off the runway and kill ourselves and nobody will stop us."

William Person: *"And possibly kill somebody in an airliner or on the ground."*

Max Karant: "Possibly so. There's no law that says you will not violate the law

vhich states that you must not drive above certain speed on the New Jersey Turnike. There is no law that says you can't o out and kill off a whole family. If you urvive, they can get you afterward for reaking a specific law, but you can't pass law that tells a man he can't violate a aw that already exists.

"I agree with you that anybody who akes off in zero-zero weather is crazy, unless he's qualified to do so. If a company pilot takes off in zero-zero weather, he robably feels he's qualified. He has the esponsibility of carrying his own people, herefore, he must feel he's qualified to nake that take-off. That's something for ou fellows to haggle out with the CAB. 3ut, to the general non-commercial public, f a human being wants to go out and ill himself, there's no way for anyone to top him, unfortunately.

"Before we close this discussion, I'd like o go back to a couple of statements that vere made at the beginning of the meetng, and report AOPA's thinking on these natters. Bill Person stated that you can't edesign the airplane. I think that's an nwarranted conclusion. We've felt for a ong time that many of these cockpits ould be modified to give pilots a lot nore visibility than they now have . . . nd we know all about pressurization, igh-speed configurations, etc. As a matter f fact, we checked some of the manufacurers some time ago and they generally greed, *a)* that modifications could be nade if someone wanted to pay for them, nd *b)* no one has ever asked them.

"I quite agree with a claim that Capt. Gill made that present regulations are adequate. But those regulations do not perit uncontrolled high-speed traffic anymore han our highway regulations do. When ou try to make the air traffic rules permit igh-speed flight and at the same time perit some pilots to not look where they re going, for whatever reason, then the vhole business gets into the ridiculous.

"To sum this whole business up as far s AOPA is concerned, '1,000 feet and 3 niles' is dangerous if the pilot comes creaming into the terminal area at 300 nph, with his attention diverted to workng knobs, switches and procedure manuals nstead of looking where he's going. Do ve clear the slower cars off the roads so he buses can cruise along at 80 mph? No, here's a maximum speed limit, and it pplies to all. Do we permit anyone—bus rivers, locomotive engineers, private moorists, or ship captains—to charge blindly head, paying little attention to what's in ront of them? I suggest someone study ie marine rules of the road in this reard. Those say that a proper watch (and ot just a cabin boy) shall be maintained t all times. Heaven help the captain reponsible for a collision!"

Capt. Van Liew: "In summarizing my inking on these matters, I'd recommend ie following:

1. Eliminate 500-on-top completely, enroute and in high-density areas.
2. Change the rule of VFR: 1,000-ft ceiling and 3 to 2,000 ft. and 5 within 50 miles on all sides of a high-density area.
3. Establish a common speed or perhaps two sets of speeds that everyone must

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Skyways Round Table

(Continued from page 37)

hold to when within 75 miles of a high-density area: 180 indicated for high-speed aircraft, and 130 for slower aircraft.

4. A constant rate of descent of 500 fpm from 75 miles out. This could be varied in pressurized equipment only at ATC's request.
5. Increased space for ATC so radar can be used for enroute control; and radar enroute control be established as soon as possible."

Capt. Kim Scribner: "I believe we must be specific in our recommendations to improve ourselves or to reduce the exposure we have to mid-air collisions. My recommendation is to:

1. Control the maximum air traffic possible in the Metropolitan Areas.
2. Raise the VFR minima in these areas for all airline operators (5 miles visibility and 2500 ft. ceiling).

"Further, in order to effect an immediate relief from potential mid-air collisions, this increase in VFR minima, when applied to aircraft over 150 mph, should minimize the opposition from the AOPA, and a majority of the hazards of fast aircraft colliding will be eliminated.

"This is in effect a compromise in that no real restriction of lightplane operation is brought to bear, but there will be effected positive control of aircraft flying in the so-called marginal VFR conditions."

B. J. Malloy: "In my opinion present CAR's are not adequate. As we know, the main problem arises in the high-density traffic areas and in the areas where there are a number of airports operating. I am not prepared to say whether raising the minimum visibility from 3 to 5 miles, or a change in the ceiling, or combination of these is the answer. I do believe, however, that high-density areas such as LaGuardia should have some special set of values even at the risk of penalizing some airspace users. I believe this is for the common good and all our laws and regulations are based on this factor, the greatest good for the largest number.

"I also would like to go on record as recommending that the CAA immediately end the double standards for instrument take-offs which are in effect at the present time. In other words, the published minimum ceiling and visibility for any airport should be binding on *all* pilots."

John J. Quinn: "My recommendations are these:

1. High-density terminal areas.

(a) The high-speed aircraft approaches to airports and operations in the traffic pattern should be conducted at safe minimum speeds, *e.g.*, not more than 180 mph.

(b) The traffic control facility at the airport should be contacted and the pilot should give his position prior to entering the area, and air traffic control should give the pilot landing information, including the number of aircraft preceding him in the traffic pattern. High-density areas should be of such dimensions as to permit low approaches to airports which it overlays and not prevent over-flights, *e.g.*, should begin at 1,000 feet and end at 3,000 feet and extend out from the airport 15 to 25 miles. The visibility should be at least 3 miles in this area for VFR flight.

2. Filing of an IFR flight plan in VFR weather conditions.

Filing of IFR flight plans whenever possible should be encouraged. It is useful to the pilot who desires to maintain constant cruising altitude when he encounters clouds. Also, with an IFR clearance he has an approved altitude in case full instrument weather conditions are encountered. Objection has been raised by some pilots against the privilege of operating on instrument flight plan in VFR weather conditions. They are of the opinion that the IFR clearance authorizes noncompliance with the VFR rules when the flight is in an area where VFR weather conditions exist. Actually, the IFR pilot is required to observe all VFR rules, such as right-of-way rules, etc., and is provided with separation only from other aircraft operating under an IFR clearance. This fact is plainly stated in aviation information releases and in the Flight Information Manual (CAA). From a practical viewpoint, since weather conditions change rapidly, it would be virtually impossible to limit IFR clearances to those enroute areas where IFR weather conditions actually prevailed. If there is a serious safety problem in this area, it appears to be rooted in the VFR rule dealing with cloud separation which specifies a clearance from clouds of 2,000 feet horizontally and 500 feet vertically. The closing rates of high-speed aircraft and higher climbing and let-down rates may require greater distance values for safety in VFR operations.

Safe separation of varying types of air-
aft and safe separation from terrain and
uctures.

This appears to call for a re-evaluation
the navigable airspace. The present
FR rules, for example, which authorize
FR operations when the aircraft is clear
clouds at or below 700 feet with visibili-
of one mile may not provide the same
gree of safety which prevailed a few
ars ago, particularly when you consider
at radio towers are now being erected
a rapid rate in most of the urban areas
the United States. Many of these towers
ll exceed 500 feet above the surface, and
me will exceed 1,000 feet. Several fatal
cidents within the past year involved air-
aft collision with towers and supporting
bles. Along with a different concept of
sibility and cloud separation, safety may
improved by more effective marking of
structions. Possibly a solution to this
fety problem could be effected by raising
e control area lower limits up from the
esent 700 to 2,000 feet or more above
e surface. There are many related factors
at must be considered in any such re-
location of airspace. These factors involve
fer separation of aircraft flown above
000 feet, either by positive air traffic
ntrol under all weather conditions or
standard quadrantal cruising altitudes
sed on direction of flight. Undoubtedly,
ny reallocation of airspace values re-
uires some give and take between VFR
d IFR operators. Presently, we are in-
lved in a major transition change in
r navigation practices occasioned by the
plementation of the VOR system of air
vigation, and it may well be an appropri-
e time to re-evaluate airspace problems
terms of modern aircraft navigational
uipment and its operational use."

illiam Person: "Summing up the fore-
ing, it is evident that 3 miles visibility
not sufficient for operating VFR when
u take into consideration both the
eeds at which aircraft fly and the
nsity of traffic in certain areas.

"The problem of cockpit designs as
ey stand now and whether or not they
n economically be modified is a topic
itself, and probably will have to be
vered at another Round Table.

"There is a strong feeling that 500-on-
p should be eliminated and that we
ould encourage the use of radar, where
is available, to control enroute traffic.

"Terminal areas should be treated dif-
rently than enroute areas insofar as
sibility is concerned. The thought put
rth was to set up one or two standard
eeds within the terminal area. Also, the
rminal areas might be extended out to
distance of 75 miles, so as to enable
pproach Control to effect separation
sed on standardized speeds. All aircraft
ould be controlled in this area. This
ght also include private pilots, or pos-
bly limit the airspace that could be
ed by aircraft not having adequate
uipment.

"Certainly, many problems have arisen
t of this Round Table discussion which
uld be material for other such meetings.
is, of course, is one of the many ad-
ntages of SKYWAYS' Round Table dis-
ssions. The operator's problems are
ankly and honestly discussed, and from
ese come thoughts for solution."

Labor Costs

(Continued from page 15)

for hourly paid personnel, and the usual semi-monthly period for salaried personnel.

To actually control and analyze the expenditure of funds against his account, such as performed on a cost-plus contract or any other kind of contract, a customer should demand that an analysis be submitted to him each day for verification and information in the three major categories of labor costs.

In addition, a customer having work performed on a cost-plus basis should also request of the overhaul facility, a daily report of all materials expended, be they direct or indirect, and the assessed cost of each. Direct material and parts should be shown with proper nomenclature and numbers, whereas indirect material should be shown in pounds, gallons, or percentage-wise where numerical costing is impossible against each direct man-hour expended.

Pay Hours and Working Hours:

When performing the audit of an air-transport overhaul, differentiation between pay-hours and working hours must be made. If a mechanic works 40 hours plus 8 hours overtime, he receives compensation at the normal hourly rate for 52 hours.

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Labor Costs

(Continued from Page 39)

Overtime Compensation:

Under the existing labor laws, work in excess of 40 hours is compensatory at a rate of one and one-half times the normal hourly rate. It is costed as 12 hours pay for 8 hours of work. Work in excess of 56 hours per week is compensatory at a pay rate of two times the normal hourly pay rate. It is costed as 16 pay hours for 8 hours work and is called premium time.

Utilization of Available Labor:

Each plane overhaul facility has a quota of skilled personnel. Thus, if 250 mechanics are available, a theoretical 2,000 man-hours is expendable each working day. For example, if five C-54 type transports constitute the maximum overhaul capacity of a repair base, then a theoretical labor expenditure of 400 man-hours per plane in work is possible. However, such is theory and the exceptions are caused by local conditions which alter the actual labor expenditure.

But efficient shop administration should maintain the work load from a daily variation of not more than 5% in order to comply with pre-planned completion schedules. In a production operation, compliance with a pre-planned schedule is only possible where the work load is maintained at a constant level in relation to man-hour expenditure.

Labor Loss Factors:

Actual available man-hours expendable in an overhaul facility are also affected by any of the following causes and a factor must be allowed for this in planning the duration of overhaul:

(1) Legitimate vacations
(2) Legitimate leaves of absence
(3) Absenteeism, loafing, errors
(4) Illness
(5) Inclement weather
(6) Leaving early on job
(7) Tardiness
(8) Legitimate rest periods

These constitute the eight basic reasons which reduce the optimum number of available man-hours from 3 to 5% as a daily average and which should be reflected in planning. Other factors which tend to slow work are labor disputes of an unauthorized nature.

Thus, a 5% daily man-hour loss is reasonable to assume, but other losses of man-hours may be attributed to the following and are within the realm of management action to correct. These are:

(1) Lack of proper hand tools, fixtures, handling equipment or improper allocation.
(2) Lack of overhaul spare parts, raw materials, or testing facilities.
(3) Generally inefficient shop practices.
(4) Geometrical configuration of the overhaul facility causing lost motion and handling.
(5) Direct lost time due to change in orders.

Regardless of the cause, much of this kind of loss can be corrected by administrative action. But remember, the customer pays for inefficiency of any kind on a time-and-material form of contract.

Labor Load per Airplane:

It is not always possible to comply with a pre-planned overhaul schedule due to delays in receipt of replacement parts, raw materials, or other causes. But the assignment of more personnel than can conveniently work on an air transport may also be wasteful of labor. Thus, the importance of the proper allocation of labor and the control of manpower.

For example, a DC-4 undergoing overhaul during the major phase of the repair operation normally cannot accommodate more than 28 mechanics working on the airplane at one time during an 8-hour shift. If more work must be accomplished on the airplane during that time, then it is better to assign an additional shift of mechanics to the job during the next work period which in this case may be the swing shift following the day shift. When more personnel than the number specified work on an air transport at one time, considerable lost motion results. However, in the overhaul shops such is not always the case because this work is not done in the confines of the airplane. But to attain the advantages of multiple shift, supporting indirect and certain non-productive labor must also be assigned.

Labor Turnover:

Where consistent work output is to be attained, the labor turnover rate must be low. High labor turnover is indicative of incompetent supervision or ineffective personnel policies. Labor turnover is figured

ccording to the following formula:

$$\text{ccession}+\text{Separation} \times \frac{P_1+P_2}{2} \times \frac{365}{M}=$$

ccessions are the hirings, and separations re the terminations. P_1 is the number of mployees on the payroll at the beginning f the pay period. P_2 equals the total numer on the payroll at the termination of he pay period. M is the number of days or which the turnover rate is figured.

It is evident from the previous discussion hat in order to audit the labor costs for n overhaul operation, certain knowledge f various labor factors must be undertood in order to attain a low cost for the vork to be done, particularly so on timend-material contracts or where the conract is for a fixed price plus a fixed fee.

Along with the production analysis hould go the labor turnover rate for the peration, and if, on the basis of this iscussion, the expended labor and mateial seem to be higher than estimated, the ustomer should bring these conditions to he attention of the management. Only by lose control of labor and material expenditures can the lowest cost consistent with uality work be attained.

Air-transport operators who use overaul facilities outside their own organizaion should consider the final audit in ight of the foregoing. Simply sending an nspector or engineer to represent their nterests during the time the work is perormed at a commercial overhaul facility oes not always permit the optimum low ost quality work to be obtained, simply ecause it is rare that technical personnel nderstand labor costs which are the major omponent of total costs. A skilled auditor hould accompany such personnel.

Turbojet Control

(Continued from page 12)

basic engine to operate closer to maximum performance limits.

Now let us assume two different failure onditions for the afterburning engine with he infinitely variable exhaust nozzle:

(a) Failure of the fuel system. If the uel system fails so that the engine reverts o a simple independent emergency system s previously described, a fixed fuel schedle becomes available for acceleration and teady-state running. This fuel schedule nust be such that under the worst possible light conditions the engine will not overemperature or over-speed. However, if area CD is chosen to determine fuel flow and he nozzle should be trimmed to GH, overemperature and possibly engine stall would ccur. If area GH is chosen to determine he fuel flow under the condition of CD, ver-speed and over-temperature would esult. The solution then calls for some ype of speed-sensing fuel control which vould fully duplicate the primary system. Obviously, the complications and weight enalties of supplying a duplicate speed overnor with all the necessary switch-over nechanisms are completely impractical.

(b) Failure of the exhaust nozzle actuatng system. If we work on the basis that he primary fuel system is operating satisactorily but the variable nozzle actuating ystem malfunctions, the situation becomes

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Turbojet Control

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even more precarious. The characteristics of many actuator systems now in use are such that, barring loss of hydraulic pressure, the exhaust nozzle can either be biased to fully open (line AB) or fully close (line GH) in case of loss of normal control. It is usually impractical to bias such an actuator control system to any intermediate position.

If the nozzle is biased fully closed (line GH in *Fig. 2)*, severe over-temperature and possibly stall will result with the throttle in military or afterburning positions. This would require immediate pilot attention and action to the extent of retracting the throttle until the engine is operating safely. Once the engine speed is reduced, the pilot must remember to carefully re-accelerate the engine, for present acceleration controls could not protect against this situation. In extreme cases it might even be impossible to accelerate, but in any case the pilot must remember that afterburning must *not* be selected.

On the other hand, if the nozzle is biased open on failure so that afterburning can still be safely selected, retarding the throttle to the non-afterburning military position would immediately drop the thrust to approximately 50% of its military value. This would hardly keep the modern fighter airborne, even if some enemy plane ignored such a "sitting duck."

If the pilot were supplied with some type of manual over-ride so that he could select either position at will, the situation would become extremely precarious in that, before he could move his throttle in either direction, he would have to stop and decide whether to open the nozzle or close it for safe operation. Obviously, this could delay pilot action drastically or, in a critical situation requiring instant action, could result in a complete loss of the engine. The fact that normally such an emergency over-ride system would necessitate an additional switch or lever which the pilot would have to actuate while handling the control stick with one hand and the throttle with the other, compounds the indecision and delay drastically.

Regardless of which of these systems is used, the pilot is given one or more switches to alert, additional warning devices he must heed, and a combination of conditions he must analyze before taking action. Faced with only fractions of a second to decide, it is no wonder that the wrong decisions are so often made.

Design Recommendations: A pilot must be provided with a single power lever which he is able to move smoothly and in the small increments required for close-formation flying. He must know that although the thrust may not be linearly proportional to throttle travel, it will at least vary smoothly without sudden surges or flat spots.

Operationally, the pilot is interested in setting a given percentage power setting and knowing it will remain approximately constant with changing ram, altitude, and temperature conditions. In this way formation flight can be maintained easily and accurately and the pilot generally is aware of the margin of power still available for accelerations or other transient conditions. Over-speed and over-temperature conditions of the engine must be automatically prevented, for it might be several minutes before they would be noted under combat conditions.

Pilots must be able to advance or retard the throttle as rapidly as necessary to obtain burst speed changes. When a fighter is on its final approach to land, it is traveling about 290 feet in each second, so the pilot must be able to increase his thrust to its full power within seconds to take a wave-off. However, the pilot will be using from 50% to 85% power on his approach up to the time he chops the throttle back to irrevocably commit himself to land. Consequently, the acceleration rates below approximately 50% thrust should not be weighed as highly as the rate in the upper power range.

Combat aircraft always fly in flights of two or more aircraft from the time they leave their field until they land. Since afterburners are used for take-off, climb and emergency periods, partial augmentation of afterburning thrust is an absolute requirement to stay in formation. It might be mentioned that the leader of a flight of aircraft will always fly at some slightly reduced power setting, leaving his wing-men some margin of power to allow for differences of aircraft drag, engine thrust, and general flight conditions. When afterburning augmentation is not available, the leader will partially drop his dive brake to slow his plane and the wing-men will adjust their speed in the same manner to position themselves in the formation. Obviously, increasing the aircraft drag to reduce speed instead of reducing fuel flow penalizes the fuel consumption of the aircraft.

Probably most important of all, the pilot needs a control system which, as far as the cockpit is concerned, is simple and automatic and provides him with sufficient control under emergency flight conditions to permit him to safely adjust power for continued take-off, to fly home, or to make an emergency go-around. It should take over automatically in case of electrical power failures. Meanwhile, the maintenance officer would like a system in which the components are easily isolated for test and replacement.

If, in order to achieve these objectives, we work on the assumption that the simpler the system is, the more reliable it can be made, we should logically concentrate on making the basic system structurally reliable, fail-safe in nature, and not suddenly or drastically affected by contaminants in the operating fluid.

From an engineer's viewpoint we can design physical components to be highly reliable structurally. After all, we daily trust control cables, wing spars, landing gear, oleos, and many other similar components. If it is recognized from the start the unit must under no condition fail, it might occasionally be wise to take a slight weight penalty in the original design to make questionable small items unquestionably safe. We should, perhaps, include a "human nature" factor which would prohibit the use of small lines, fittings or other objects which might tempt the grown-up boy who just "knows" an 18" wrench is better than the 6" unit specified.

Probably the greatest single factor the engineer must contend with is that of fuel contamination, for actual service conditions have shown that although maintenance and supply personnel can do a great deal to help keep fuel clean it will inevitably be contaminated to some degree. Ideally, the control system should give the pilot good control and full power regardless of the contamination. However, the state of the art being what it is, we cannot design metering valves guaranteed to operate under any degree of contamination, nor can we supply filters large enough to clean flows of 30,000 to 40,000 pounds per hour within reasonable space and weight limitations.

However, let's look in the cockpit again. The pilot is interested in a high-performance aircraft, but also in one which will bring him safely home again. If he is taking off, he must be able to complete his take-off and climb sufficiently to make an approach and land the aircraft after recognizing an impending failure. This means that any effects of contamination must be gradual and of such nature that a reasonably alert pilot can detect the condition and take action.

Logically, we can assume a pilot will not start a take-off unless he has full power. At this point all fuel valving will be in the correct metering position to handle the fuel, and it is reasonable to assume any sticking of valves will occur in roughly the position being held. Therefore, with a stable system, these valves will continue to roughly control flow. As long as the design does not include small servo valves with light differential actuating forces, such a system should, when over-contaminated, give a gradual deterioration of performance. Thus, the pilot should have sufficient warning to either land or take other emergency measures.

The detail design considerations necessary to provide these general control characteristics are considerably beyond the intended scope of this article, but we might briefly state the more obvious.

1. Any valve or mechanism mechanically and continuously rotated will keep itself clean and free. Since its physical design is straight-forward, this type valving can be considered reliable and dirt insensitive.

2. Poppet valves can be designed so that their guides do not have an appreciable pressure drop across them to trap dirt. Under these conditions, a poppet-type valve can be made virtually dirt-insensitive due to its reciprocating motion and its unrestricted flow passage.

3. Piston-type valves must in many cases be used when leakage or particular metering characteristics are required. This type of valve is very susceptible to dirt but, if mechanically actuated, is quite reliable in small diameters. If it is dependent on pressure drop across itself for actuation, it should be large enough so that moderate flow changes can give high restoring forces. The hydraulic forces available to actuate such a valve is a function of the square of the diameter, whereas the frictional force is essentially proportional to the first power of the diameter.

4. Small orifices, either singly or in series, are to be avoided as much as possible, as must small needle valves. Their very nature makes them extremely dirt-susceptible in small diameters. When they

nust be used, some protection should be provided such as multiple inlet openings, ndividual filtration or precipitation chambers, just to mention a few possibilities. The needle valves themselves must not be so small as to be prone to structural failure.

5. Combinations of valvings should be arranged so that sticking of an individual servo valve or orifice cannot drive the main regulating valves to either extreme position, but rather simply cause them to err by a moderate amount.

Recommended Control System

One control system which evolved from a recognition of the considerations heretofore discussed is believed to incorporate a high degree of inherent reliability. Essentially, it consists of a simple basic control system capable of safely operating the engine throughout the full range of the throttle lever travel, and which is trimmed to obtain the maximum performance in military and afterburning power settings. Engine rpm is controlled by governing fuel flow, and engine temperature is controlled through the exhaust nozzle area. The two systems are interlocked by the linkage to the common pilot throttle lever (*as shown schematically in Fig. 4*).

The fuel-control system contains a controlling valve of proven reliability to provide a flow-scheduling regime by maintaining a fixed pressure drop across a manual throttle valve, a simple barometric acceleration control, and a flyball topping governor. The design incorporates:

1. Maximum simplification consistent with the job to be done.
2. A high margin of safety of all components, particularly springs and small components.
3. The pressure-sensing bellows is so arranged that the highest pressure is on the outside. Thus, pressure will tend at all times to close any possible bellows rupture.
4. Stable valve design such that sticking of valves will tend to maintain an existing fuel flow which can be reduced by the manual throttle valve.
5. The rotating flyball-governor has been proven highly reliable by extensive past usage. It is highly insensitive to dirt because of its rotation.

The exhaust-nozzle actuator control system is composed of a mechanical scheduling control which directly strokes a pilot valve controlling the admission of high-pressure oil to the exhaust-nozzle actuator. A mechanical feedback completes the servo-loop to neutralize the pilot valve.

The actuator control, containing a linkage computor, converts power lever angle into exhaust nozzle position, subject to over-rides for low-engine rpm and afterburning, and subject to change by an automatic temperature control. The throttle-area relationship is shown in *Fig 2*. Line ABCDEF represents the basic hot-day schedule of the computor. An under-speed condition maintains the area at ABB^1 until the speed is on schedule and the control takes over. Temperature trimming closes the nozzle beyond the hot-day area (CD) to area GH or, in afterburning, to area K. Until afterburning is actually in operation, area CDD^1 is maintained.

(Continued on page 46)

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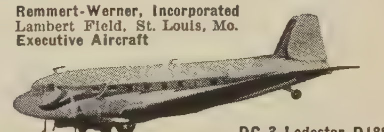

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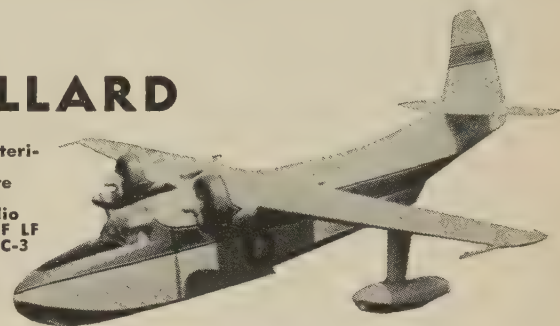

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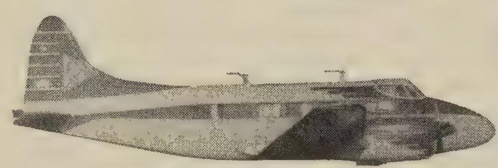

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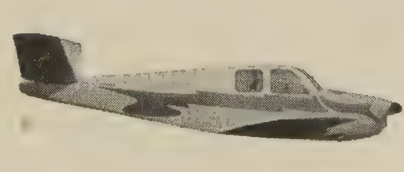

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Turbojet Control

(Continued from page 43)

The system is designed to incorporate the maximum of reliability and fail-safe features. The pilot may at any time erase all trimming functions by disconnecting the electrical power to simulate manually a loss of power. Thus, regardless of electrical or other malfunctions of the trimming circuitry, the pilot still has a basic system available to give him good basic control which will provide any degree of power, from idle to afterburning, he may select. It is so arranged that in case of electrical or other failure the pilot can continue take-off and fly for an indefinite time without endangering the aircraft.

In summary, we should recognize that under the stress of modern jet flight and especially under emergency conditions, the time available for pilot recognition of a condition and his reaction to it precludes anything but automatic and instinctive reaction. Control design must, therefore, give consideration to this factor by providing a regime such that the pilot will instinctively know how and what to do.

Emergency provisions are a complicated subject, but essentially they should provide sufficient thrust to enable the pilot to safely complete a take-off once he has passed his "point of no return." This differs considerably in implication where concerned with single- as against multiple-engined aircraft.

Provisions must be made to operate with contaminated fuel for sufficient time to allow a pilot to complete a take-off and, if possible land.

It has been the intention of the writer to convey to the technical world the highlights of a pilot's viewpoint in the hope of provoking further design consideration of that over-worked and oft-ignored mortal, the thottle jockey.

This article is an adaptation of a paper presented by Mr. La Croix at the Annual Meeting of the SAE at Detroit.

Power Required Curve

(Continued from Page 13)

ing a take-off from a muddy field. The tail may have been held low in order to obtain as much lift as quickly as possible, resulting in a stall take-off. In all probability, even though the plane may have just cleared the ground, its partially stalled attitude prevented further acceleration and climb-out, so power was cut for another try at it.

A more common condition is that where a large aircraft is set up for long-range cruise and will stabilize out at an airspeed of, say, 150 IAS after climb to flight level. However, if the aircraft is dived down gently for a hundred feet or so, the airspeed will build up and then stabilize out to, say, 180 IAS; an increase of 30 mph which is no small increment in long-range flight operations.

The fact remains that the phenomenon, though more likely to occur with underpowered aircraft at high gross weights, can occur with any aircraft, and is apt to be experienced on multi-engine aircraft at high gross weights and low speeds where one or more engines fail and only a small margin of climb performance remains.

The factor which primarily determines whether or not this condition is reached is airspeed.

Before continuing with the discussion, it is important to consider some aerodynamics with respect to Thrust Horsepower Required (THPr) curves and Thrust Horsepower Available (THPa) curves. Basically, a power-required curve is a plot of Thrust Horsepower Required for flight at airspeeds from stall on up to the maximum flight speed. The curve looks like the one shown in Fig. 1.

Notice in particular that the THP required for flight at speeds close to stall speed is higher than that required for speeds somewhat above stall. The curve then proceeds upwards at the higher velocities requiring increased THP. The minimum power to maintain flight is at the bottom of the curve at point M. Plots of THP-required curves are seldom available to the lay pilot and usually can only be obtained through the aerodynamics departments of the manufacturers. These curves are plotted for various gross weights, altitudes, and airplane configurations. For our purposes, we will assume one condition for a fictitious twin-engine airplane. The conditions assumed are that the aircraft is in the take-off configuration at maximum weight at sea level.

It is important that we understand that the THPr curve shown in Fig. 1 is a combination of two separate and distinct curves which are shown in Figs. 2 and 3.

Figure 2 is a plot of the induced THPr due to wing drag. Since at low speeds the wing angle of attack is high, the induced wing drag is high and, therefore, the induced THPr for the wing for flight is high, decreasing at higher velocities and lower angles of attack to a minimum at maximum velocity. Figure 3 shows a plot of parasite THPr due to drag of items such as fuselage, wings, tail, wheels, etc. This curve starts out from the left at 0 velocity and 0 THP and increases in slope to the right, with maximum THP required at maximum velocity. If Figs. 2 and 3 are superimposed (as in Fig. 4) and their ordinates added together, we arrive at the total THPr for the wing and parasite items (shown as a dotted line) for the complete airplane which already has been shown in Fig. 1.

Now that we have a THPr curve for our airplane, we must go a step further and add a Thrust Horsepower Available curve (THPa) to the graph in order to arrive at the complete performance picture. This is shown as two curves in Fig. 5; one curve for both engines operating at T.O. power, and one curve for one engine at T.O. power.

Notice how the THPa curves slope upward to the right. This is because of variations in prop efficiency and other factors varying with increasing velocity. Point D represents the maximum velocity obtainable in level flight with both engines at T.O. power. This is the point where the THPa for both engines crosses the THPr curve. At speeds lower than that corresponding with point D, excess power is available which can be converted into rate of climb. For example, take point B on the THPa curve for both engines. The difference between B and B^1 represents the excess THP which can be converted to rate of climb. It appears that this is about the maximum height between these two curves. The corresponding velocity straight below BB^1 would then be the speed for best rate of climb on two engines. The actual rate of climb can be calculated by the formula:

$$\text{Rc (ft/min} = \frac{\text{Excess THP x 33000}}{\text{Weight}}$$

In order to fly at a speed higher than that corresponding with V-max at point D, the airplane would have to descend.

Now let us examine the THPa curve for one-engine operation, curve AC. Notice that this curve crosses the THPr curve at two points, A and C, where both points are above the stall speed Vs. For the single-engine T.O. power condition set up in the cockpit, points A and C are two conditions where for the same RPM and Manifold Pressure the airplane will just maintain level flight. At any point between A and C, a THP differential exists which can be converted into climb (small, but positive). Beyond point C the airplane must descend in order to fly at an airspeed higher than that corresponding with point C. At speeds lower than that corresponding with point A the airplane must also descend since the THPa becomes less than the THPr. We are now at the crux of the discussion—the fact that in a speed range above stalling it is possible to be flying at a speed at which it is actually not possible to climb, or to even maintain altitude. If altitude were held, the airspeed would drop gradually until the airplane stalled. The only way to get out of this condition, that is, to get back into the positive rate-of-climb range between points A and C, is to either add more power (which we assume not possible) or to increase airspeed by diving. Once this is done, the airplane can then begin to climb since a positive differential of THP now exists. Conditions could exist, however, where the

(Continued on page 48)

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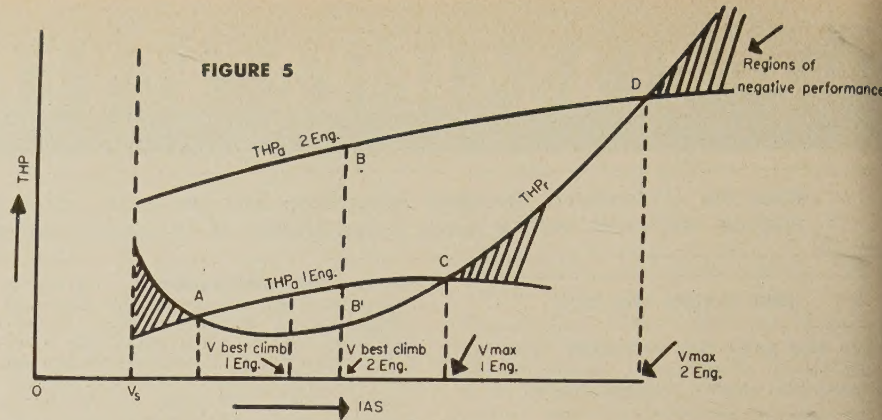

Power Required Curve

(Continued from Page 46)

airplane might be too low to permit diving for extra speed.

It is well to keep in mind that on some aircraft with high gross weight and partial power, it may be possible to have a negative rate of climb at speeds considerably higher than the minimum control speed of the airplane on single engine. For this reason it becomes obvious why it is important to accelerate to at least V2, the minimum recommended take-off and climb speed of the airplane, and as quickly as possible thereafter to accelerate to the recommended best single-engine rate-of-climb speed of the airplane, and then, of course, on up to the recommended normal climbing speed of the airplane, assuming the engine operation is normal. These techniques become even more important to the executive pilot who may be operating heavily loaded out of airports above sea level and not subject to T category restrictions on weight such as would apply to an air carrier to insure adequate performance in the event of engine trouble. Inadvertant take-off at too low an airspeed with subsequent engine loss, or reduction of airspeed to too low a value during engine failure after take-off are the main considerations which might lead to difficulty.

Two classic examples of attempts to take-off on the back side of the power-required curve at full power can be fairly well interpreted from the accident reports covering two foreign jet transports which attempted to pull off the ground too soon. Neither aircraft was able to continue flight and both crashed beyond the boundaries of the field. Ground effect, which has been intentionally avoided to simplify this discussion, was probably responsible in part for rendering the aircraft airborne at too low an airspeed and giving a false sense of performance. Unfortunately, any increased performance gained by ground effect decreases rapidly to 0 once the airplane breaks ground and begins climbing. In the main, however, the fact is that at the airspeed at which flight was attempted on the take-off run, the power available for flight was very close to and probably a little less than the power required, resulting in inability of the aircraft to continue acceleration to higher speeds and climb rates. Fortunately for jet aircraft, the engines are being improved to the point where greater static thrust ratings are resulting in improved acceleration characteristics in the low-speed range. Propeller-driven aircraft have an inherent advantage in having high-thrust characteristics in the low-speed range which tend to accelerate the aircraft through the take-off speed range very rapidly.

In closing, it might be emphasized again that the aircraft manufacturer's recommended airspeeds should be adhered to, particularly in the event of emergencies. Flying an exact airspeed to get maximum climb performance is not nearly as important where plenty of power is available as it is under partial power conditions. With partial power the airspeed range where positive performance can be obtained can become very narrow, and under certain conditions may be extremely important to hold exactly for positive performance. For this reason it is recommended that airspeed indicators occasionally be calibrated so that a pilot knows whether they are reading correctly in the critical ranges. For instance, if the minimum control speed of a particular aircraft on single engine is 85 IAS but the cockpit reading due to instrument error is 5 mph high, the pilot could believe he had reached 85 IAS when actually he is only at 80 IAS. By the same reasoning, he could also be off on recommended speeds for best climb and other speeds for normal and single-engine operation.

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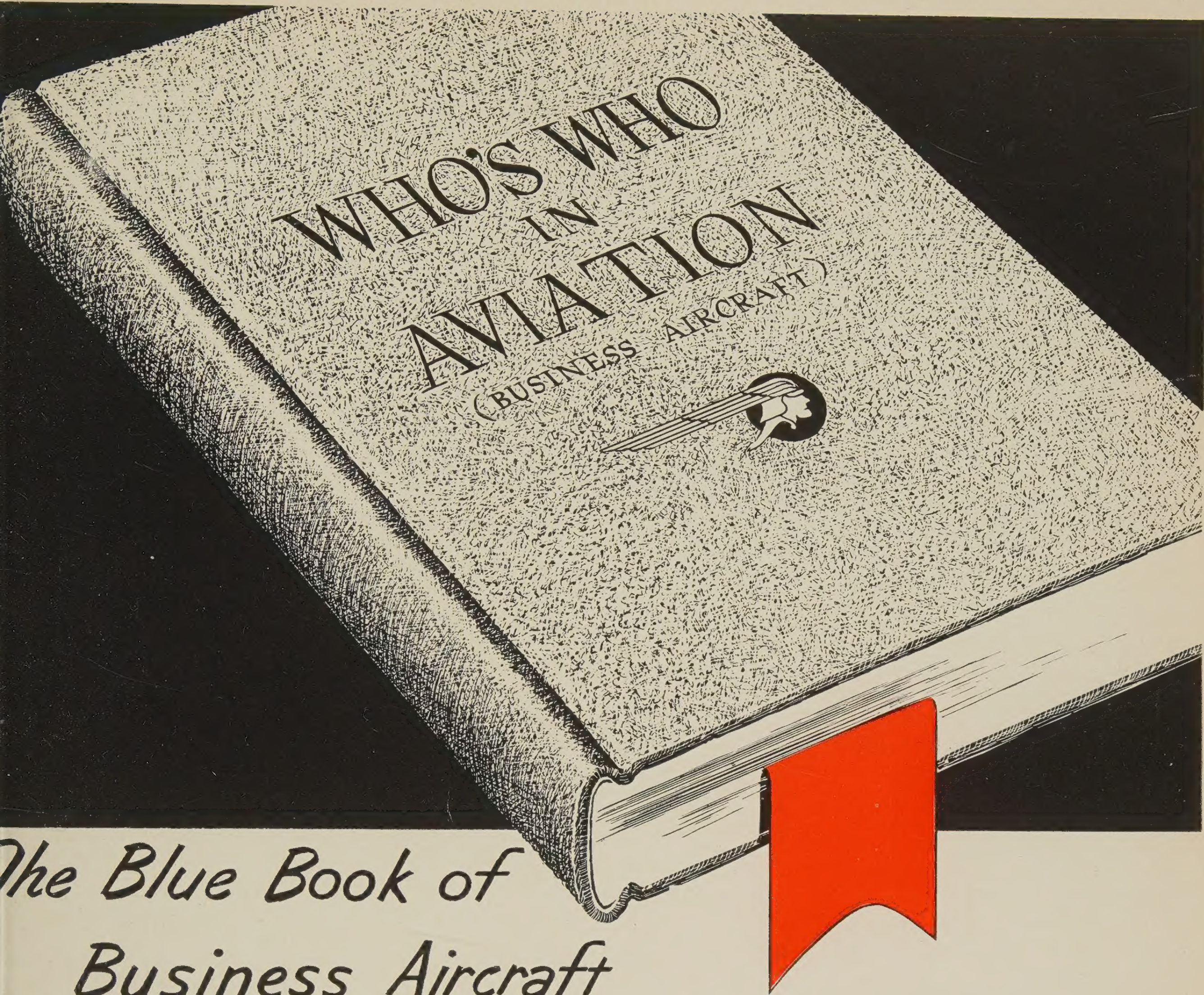

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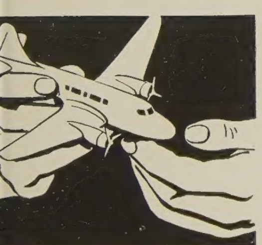

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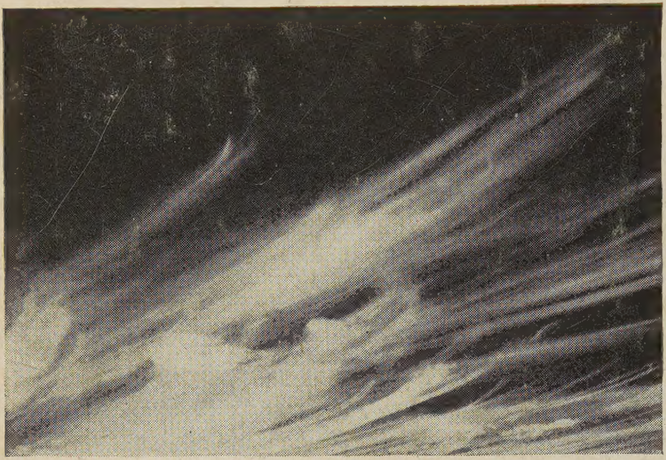

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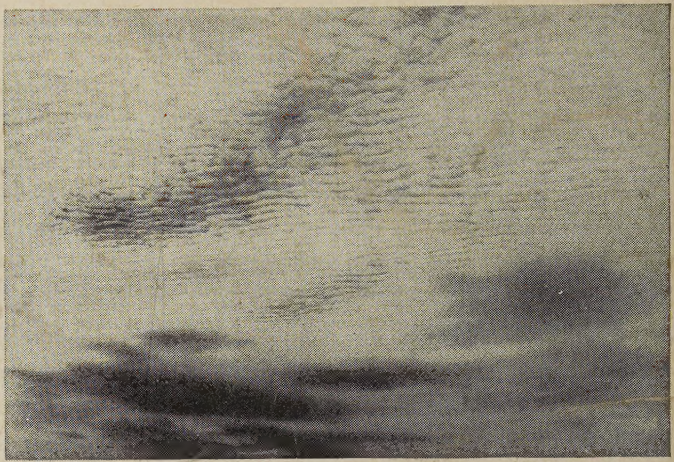
CIRRUS — Long distorted streamers (above) identify the strong, shearing winds of the recently discovered JET STREAM. Generally, streaking from NW—means continued fine weather. Spreading from SW—possible rain.



ALTO-CUMULUS—Use the roll structure of such clouds to determine wind direction aloft. Wind blows across the corrugations at right angles to the rolls. Expect light to moderate turbulence when flying near these clouds.

STRATO-CUMULUS—Look for smooth flying above this flat cloud deck. The top surface marks an inversion where temperature increases with altitude. Be careful of icing when descending through the deck in winter months.

PHOTO — PAN AMERICAN WORLD AIRWAYS

CUMULO-NIMBUS—The thunderstorm cloud commonly called a "CB". Watch for squall line development when "CB's" begin to line up northeast—southwest in late afternoon. Such danger usually decreases by midnight.

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